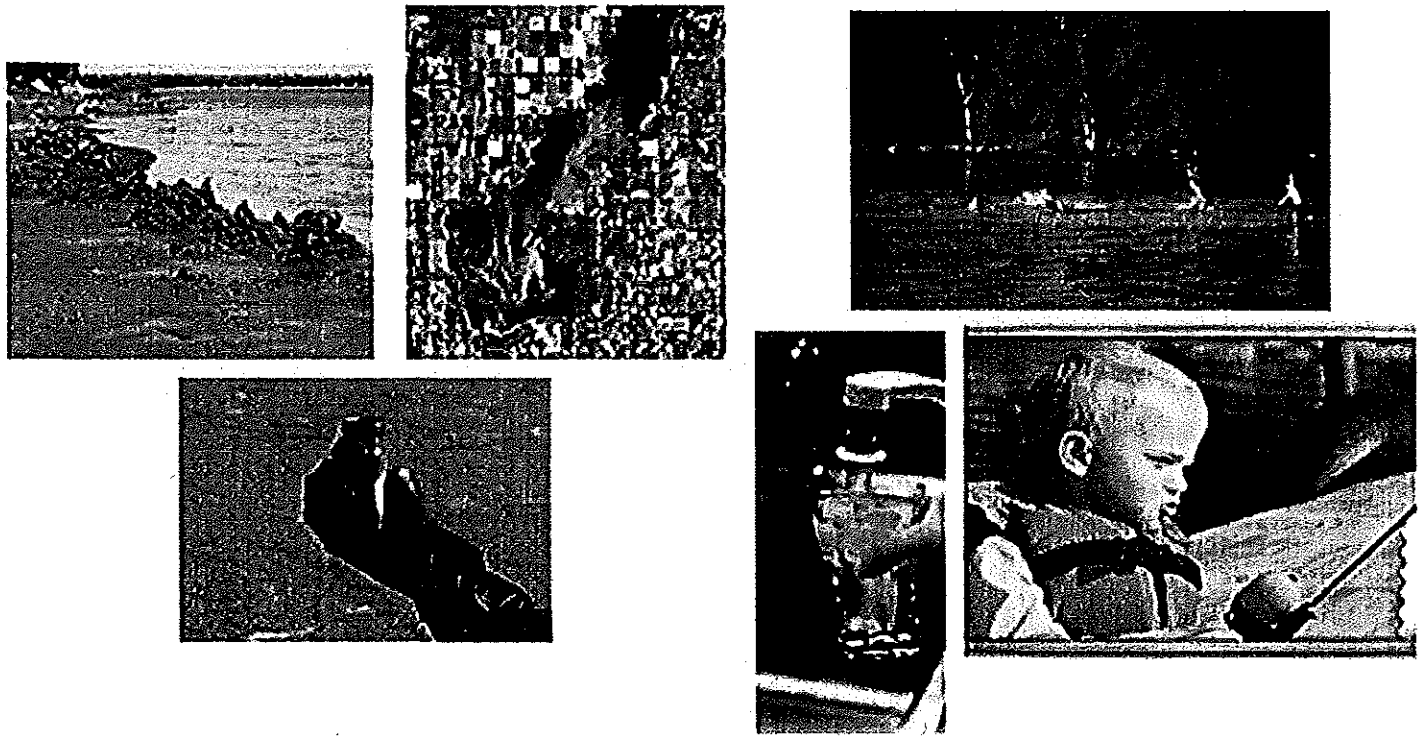
Wisconsin's Nutrient Reduction Strategy

August 5, 2013 Draft



Wisconsin's Nutrient Reduction Strategy

A Framework for Nutrient Reduction and Management

REVIEW DRAFT

August 5, 2013

This document was developed by the Department of Natural Resources with contractual assistance from the University of Wisconsin – Extension. Substantial input from staff of other federal, state and local agencies was provided, especially on work groups convened to fill programmatic gaps and to enhance coordination. It was the intent of the Department of Natural Resources to provide information on nutrient reduction activities within Wisconsin regardless of the level of government or particular agency. To keep the document to a reasonable size, all programs and activities could not be described in detail. For more information, the reader is encouraged to go to websites identified in the text.

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Executive Summary

Key Points in Wisconsin's Nutrient Reduction Strategy

Introduction

- Wisconsin's Nutrient Reduction Strategy was developed in response to the *Gulf Hypoxia Action Plan 2008* call for each state in the Mississippi River Basin to develop a strategy by 2013 to reduce the amount of phosphorus and nitrogen carried in rivers from the state to address the biological "dead zone" in Gulf of Mexico. It was also developed in response to the call from the U. S. Environmental Protection Agency (EPA) for states to develop frameworks for nutrient reduction as outlined in the March 2011 memo from Nancy Stoner, Acting Assistant Administrator for Water. Although EPA will review and provide comment on this strategy, it does not require EPA approval. Having a completed strategy may make Wisconsin eligible for additional federal funding and may be necessary to retain existing grants.
- Wisconsin's Nutrient Reduction Strategy was developed to not only meet the federal Gulf of Mexico hypoxia nutrient reduction goals, but to meet intra-state needs for Wisconsin's lakes and streams and groundwater. It also includes needs for the Great Lakes consistent with Annex 4 of the Great Lakes Water Quality Agreement of 2012.
- Past implementation efforts have reduced by about 23 percent the amount of phosphorus from Wisconsin watersheds to the Mississippi River and by about 27 percent to Lake Michigan. By continuing to implement existing state and federal programs, Wisconsin can meet the 45 percent reduction goal for the Mississippi River Basin.
- This strategy does not call for new regulations for either point sources or nonpoint sources. It builds on existing programs and existing requirements, including those adopted in the last few years.
- This strategy is generally organized around the eight elements outlined in EPA's March 2011 memo. However, it also addresses the essential strategy components to implement the *Gulf Hypoxia Action Plan 2008*. It is intended to be a "living" document that changes to reflect new developments and advances in Wisconsin's nutrient reduction efforts.

State Nutrient Reduction Strategy Components and EPA Framework Elements[1]	
Essential Strategy Components Identified by States	**EPA Framework Elements**
Characterizing Watersheds and Identifying Nutrient Sources and Contributions	1. Prioritize Watersheds on a Statewide Basis for Nitrogen and Phosphorus Loading Reductions
Priority Setting	
Evaluating and Selecting Appropriate Analytical Tools	
Establishing Quantitative Reduction Targets	2. Set Watershed Load Reduction Goals Based upon Best Available Information
Establishing Current Status and Historical Trends	
Examining Current Regulations, Programs, and Policies	
Identifying and Documenting Appropriate Management Practices and Technical Assistance Programs (Input Management, Water Management, Proven and Innovative Nonpoint Source BMPs, Point Source Management)	3. Ensure Effectiveness of Point Source Permits in Targeted/Priority Sub-watersheds for WW facilities, CAFOs, and Urban Storm water
	4. Agricultural Areas
	5. Storm Water and Septic Systems
	6. Accountability and Verification Measures
Designing and Implementing Effective Monitoring	
Identifying and Creating Economic Incentives and Funding Sources	
Additional Strategy Components Identified by States	**EPA Framework Element**
Involving and Engaging Stakeholders	
Effective Education and Outreach	
Tracking and Reporting Progress	7. Annual Public Reporting of Implementation Activities and Bi-annual Reporting of Load Reductions and Environmental Impacts Associated with Each Management Activity in Targeted Watersheds
Developing Numeric Nutrient Standards	8. Develop Work Plan and Schedule for Numeric Criteria Development

Figure ES.1 Comparison between Gulf Hypoxia Task Force components and March 2011 EPA memo elements.

Chapter 1. Targeting/Priority Setting

- Nutrient contributions come from both point sources and nonpoint sources throughout much of the state. For the Mississippi River basin portion of Wisconsin, 80% of the nonpoint source contribution of phosphorus comes from 20 of the 30 major river (HUC 8) basins. Similarly for the Lake Michigan basin, 80% of the nonpoint source contribution comes from nine of the 13 major river (HUC 8) basins. The relative point source and nonpoint source nutrient contributions vary greatly by basin

[1] Gulf Hypoxia Coordinating Committee

This strategy uses the federal agency watershed coding system, the Hydrologic Unit Classification (HUC) system. The number of digits in the code increases as the size of the watershed decreases. The average size of a HUC 10 watershed in Wisconsin is about 150 square miles (100,000 acres) while the size of a HUC 12 watershed is about 30 square miles (20,000 acres).

- Initial lists of high priority "top group" HUC 10 watersheds comprising about 10 percent of the state's watersheds were developed for the Mississippi River Basin and Lake Michigan Basin for phosphorus and nitrogen to surface waters and for nitrates in public drinking water wells. The initial list and subsequent updates of the list may be used in selection of future federally-funded implementation projects.

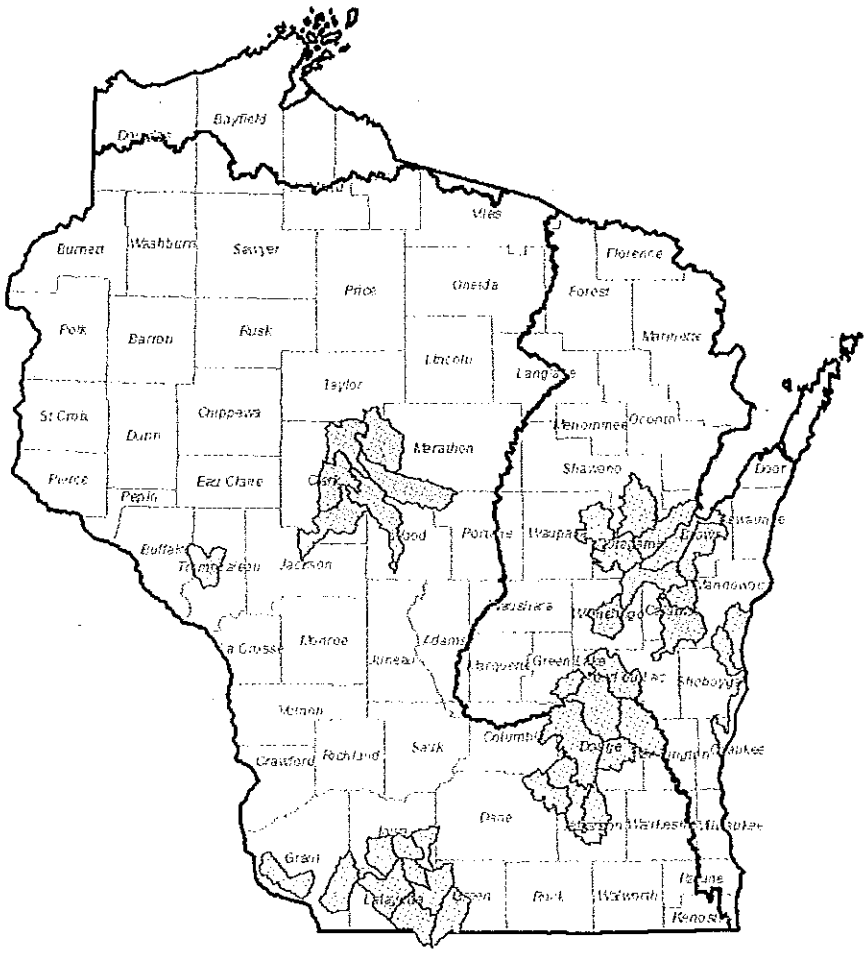

Figure ES.2 -- Top Group Watersheds for Phosphorus

Figure ES.3 Top Group Watersheds for Nitrogen

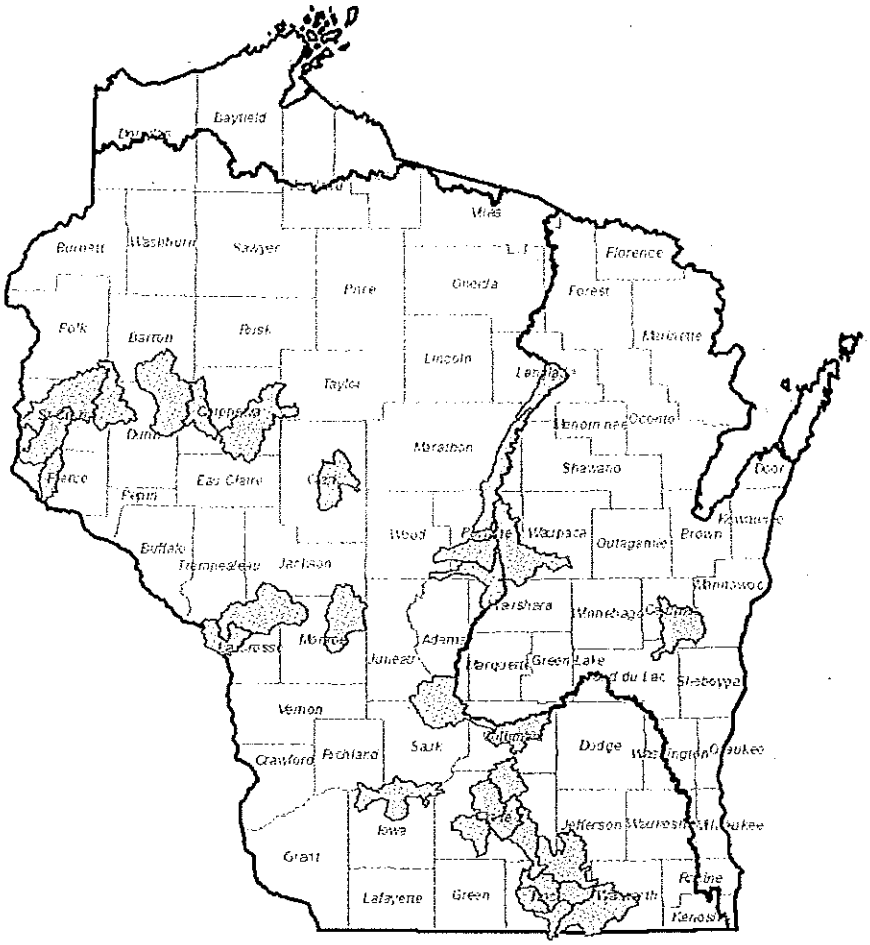

Figure ES.4 Top Group Watersheds for Drinking/Groundwater

Chapter 2. Setting Nutrient Reduction Targets

- Recent stream water quality monitoring conducted by DNR shows a broad range of phosphorus and nitrogen concentrations as illustrated in Figures ES.5 and ES.6. About half of Wisconsin streams meet the phosphorus water quality standards criterion. There are no water quality standards criteria for total nitrogen or nitrate.

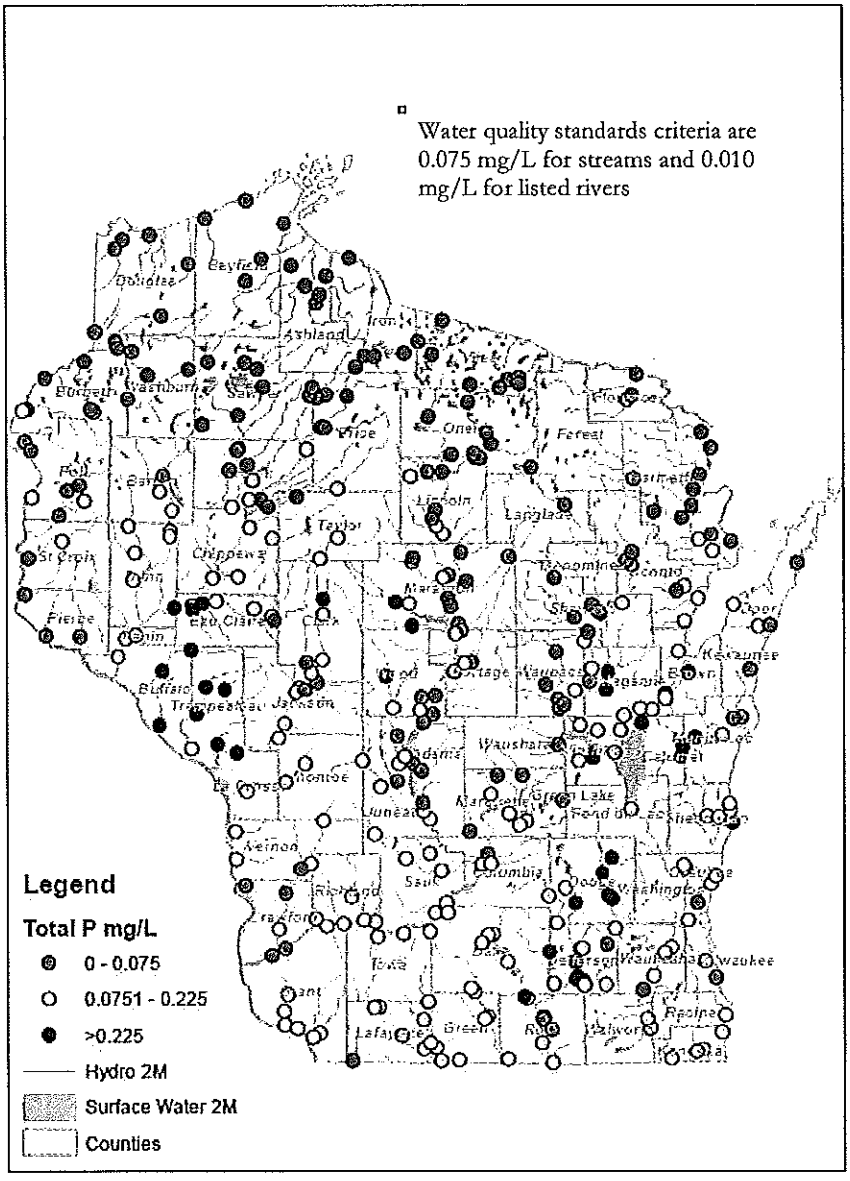

Figure ES.5 Stream Phosphorus Concentrations (median May – October)

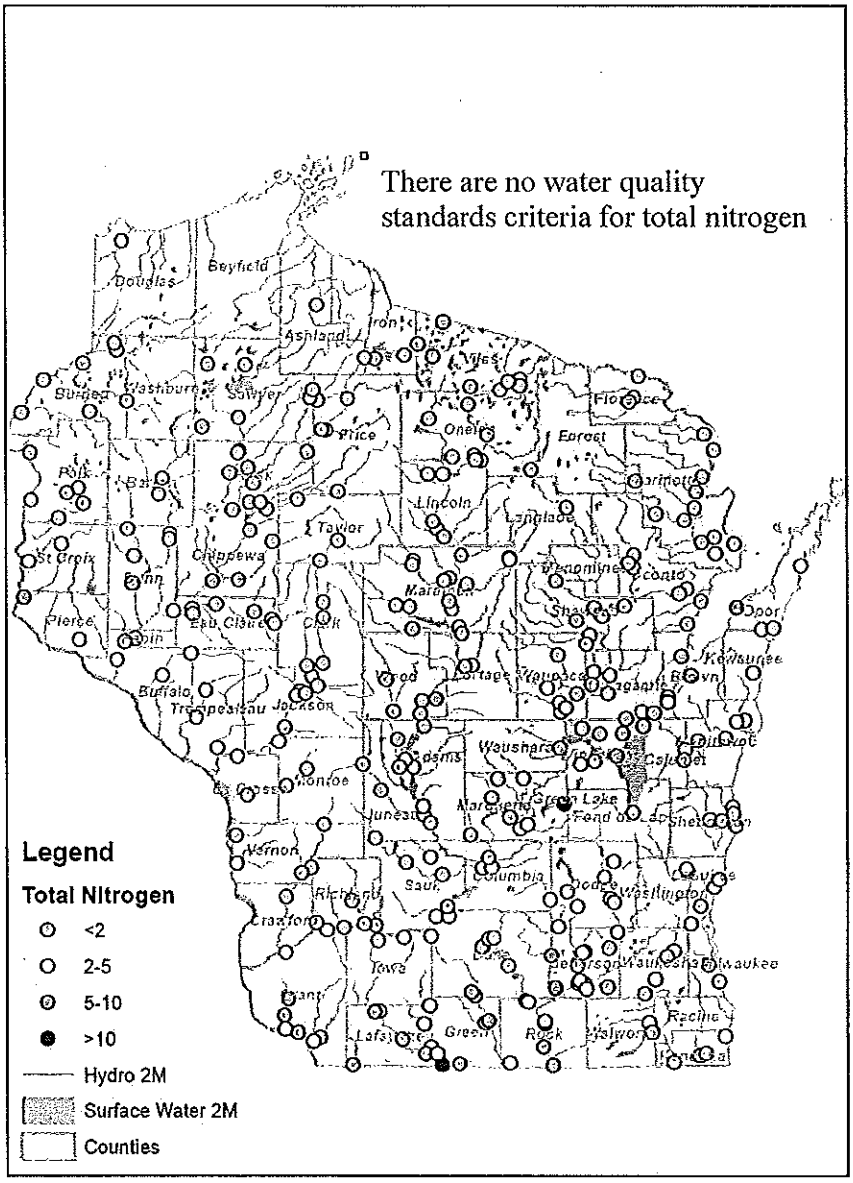

Figure ES.6 Stream Nitrogen Concentrations (median May-October)

- As shown in Figure ES.7, many of Wisconsin's public drinking water systems have elevated nitrate concentrations with some exceeding the enforcement standard of 10 mg/L.

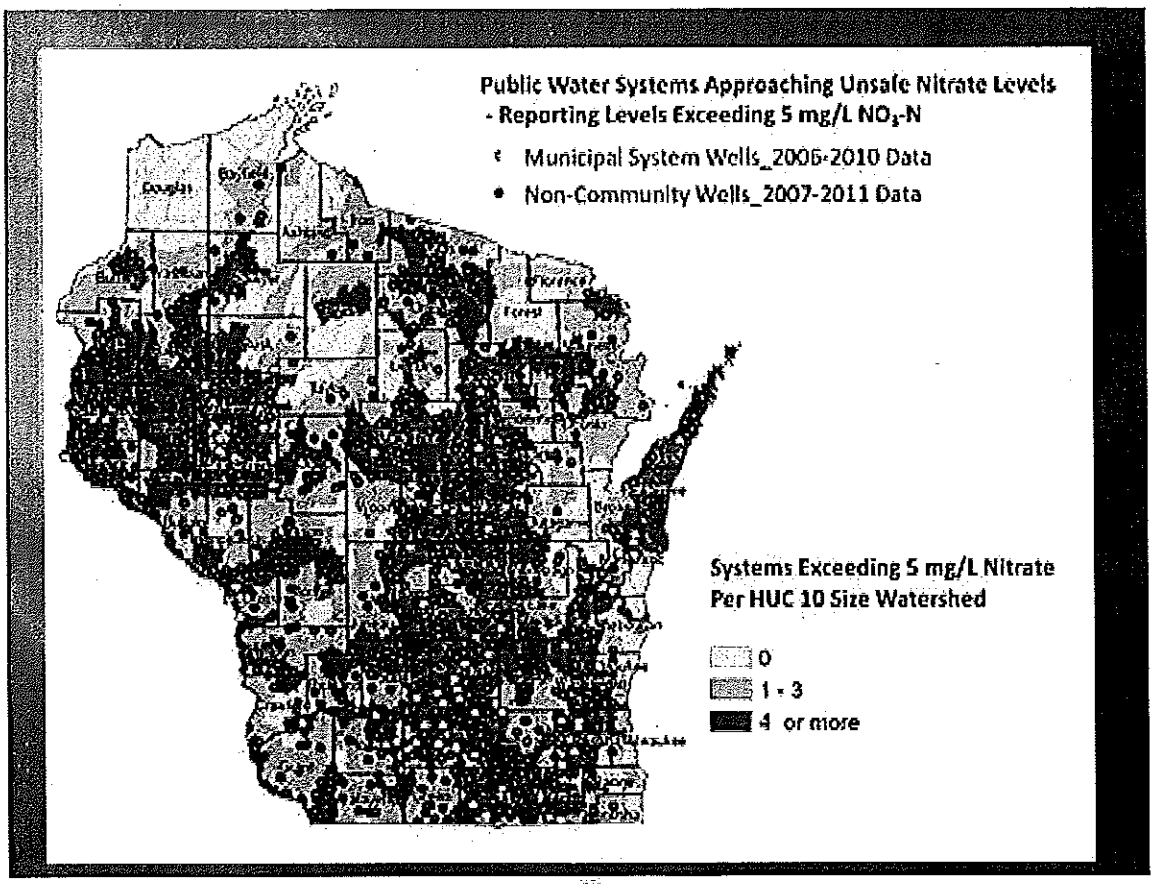

Figure ES.7 Public Water Systems with Nitrate Concentrations exceeding 5 mg/L

- An initial analysis shows that existing Wisconsin point source and nonpoint source programs can meet the Gulf Hypoxia goal of 45% load reduction for phosphorus using 1995 as a base year. For the Mississippi River Basin, about a 23% reduction has already been achieved through implementation of Wisconsin's point source phosphorus removal requirements and through a number of nonpoint source management programs. For the Lake Michigan Basin, an estimated 27% reduction has been achieved.

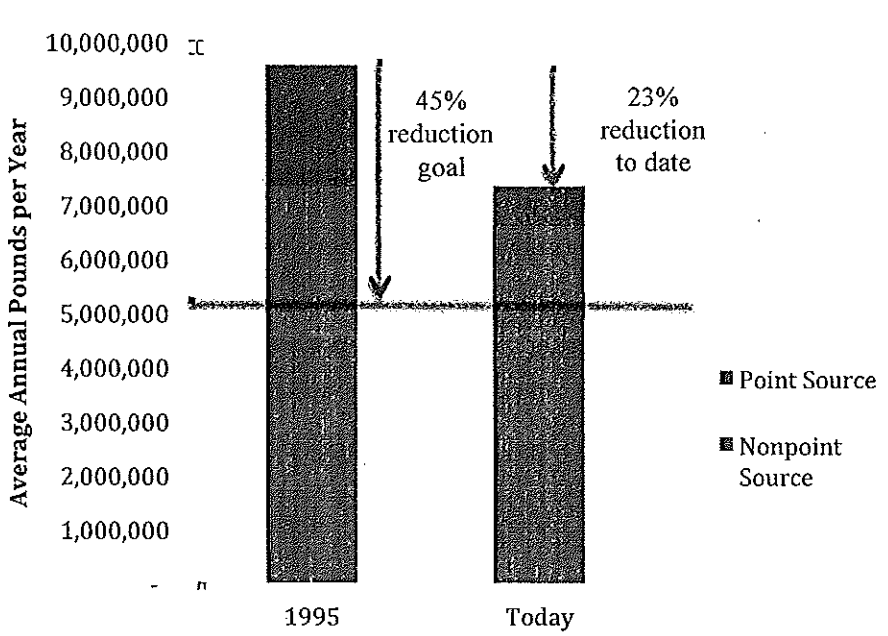

Figure ES.8 Gulf Hypoxia Phosphorus Load Reduction Goal and Estimated Progress to Date

- Trend analysis of data collected over more than three decades at long-term monitoring river monitoring sites shows a decrease in phosphorus concentrations for much of the southern half of the state. In contrast, nitrogen concentrations have increased somewhat.

Chapter 3. Point Source Permits

- Wisconsin has point source programs in place to manage phosphorus from municipal and industrial wastewater facilities, Concentrated Animal Feeding Operations (CAFOs), and municipal urban storm water. In 2010, Wisconsin adopted administrative rules requiring further discharges of phosphorus to meet water quality standards. Innovative, cost-effective compliance alternatives have been developed and approved by EPA.

Chapter 4. Agricultural Nonpoint Nutrients

- Wisconsin also has a number of federal, state and local agricultural and rural nonpoint source programs to control nutrients. Control of phosphorus was enhanced by the 2011 adoption of a phosphorus index for farmlands as part of its suite of state-adopted enforceable performance standards and prohibitions.
- In 2013, federal and state agricultural nonpoint source financial and technical assistance grants will exceed $50 million.
- This strategy recommends that a Nitrogen Science Summit be convened to identify what technical tools need to be developed to better manage nitrogen in an efficient and cost-

effective manner. Although such a science summit was conducted by Iowa, many of their conclusions do not apply to Wisconsin's predominantly livestock agriculture.

Chapter 5. Integrating Point Source and Nonpoint Source Management

- Wisconsin has placed a priority on integrated point source and nonpoint source management through:
  - TMDL development and implementation;
  - Development and use of tools, such as PRESTO, to identify the relative importance of point source and nonpoint source contributions of phosphorus at both large and small watershed levels;
  - Implementation of the watershed adaptive management option, a point source compliance alternative; and
  - Allowance of water quality trading, another point source compliance alternative.

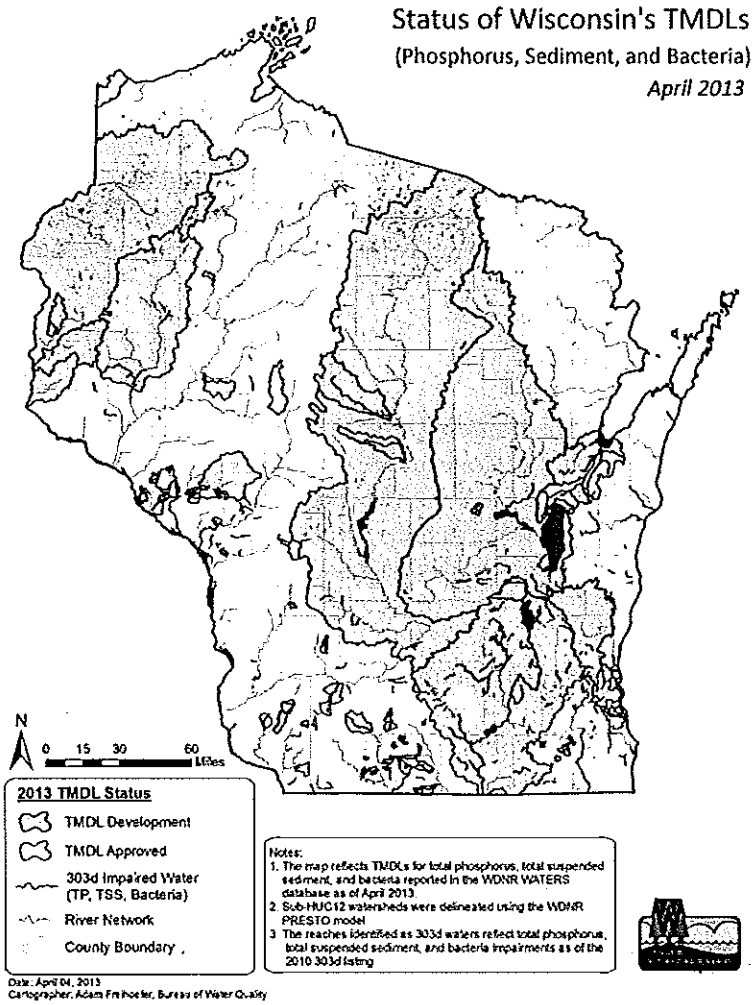

Figure ES.9 Status of Waters Impaired by Phosphorus, Sediment and Bacteria

Chapter 6. Storm Water and Septic Systems

- Wisconsin has programs in place to manage on-site disposal systems, phosphorus in lawn fertilizer and phosphorus in detergents. A number of Wisconsin's nonpoint source performance standards apply to non-permitted urban areas.

Chapter 7. Accountability and Verification Measures

- A multi-agency work group is developing an integrated tracking for agricultural nonpoint sources. It is based on county systems for tracking compliance with Chapter NR 151, Wis. Adm. Code, performance standard and prohibitions and Farmland Preservation/Working Lands Initiative. Information reported to state agencies is aggregated at the HUC 12 small watershed level along with point source tracking information. Development of the agricultural nonpoint source system will continue as a multi-agency, state-federal-local effort throughout 2013. Point source reporting for phosphorus discharges is well established. Nitrogen discharge reporting has been increased for major facilities in the Mississippi River Basin.

Chapter 8. Water Quality Monitoring

- Water quality monitoring is an integral component of many of the elements in this strategy and will continue as a multi-agency effort. DNR will continue to use its River Long-term Trend sites to analyze trends and is considering ways to enhance this fixed-station network. Many of these River Long-term Trends sites are parts of multi-state networks for the Great Lakes and Mississippi River. Other monitoring activities are identified to address nutrient-related concerns in in-state lakes, streams and rivers.

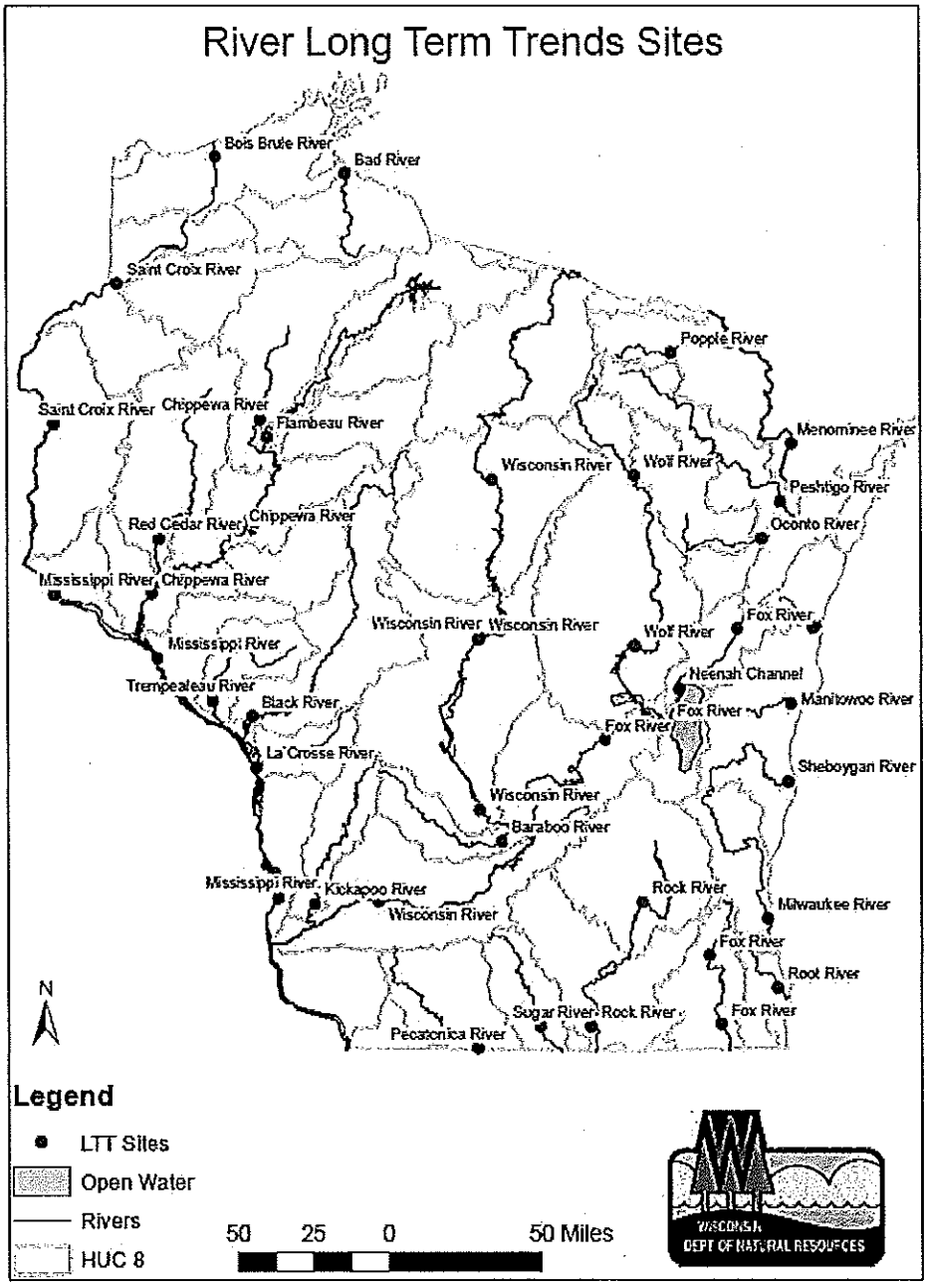

Figure ES.10 Wisconsin's River Long-Term Trends Monitoring Sites

Chapter 9. Reporting

- Wisconsin will report on nutrient reduction progress through an annual nutrient summit and information on a website, consistent with the EPA reporting element. The annual nutrient

reduction summit may be held in conjunction with period point source phosphorus control summits.

Chapter 10. Numeric Nutrient Water Quality Criteria

- In 2010, Wisconsin adopted numeric phosphorus water quality standards criteria for rivers, streams, lakes, reservoirs and the Great Lakes. DNR continues to research the impact of nitrogen on biotic stream systems.

Table of Contents

Introduction

Wisconsin's Nutrient Reduction Strategy is a broad overview of nutrient management activities for both point sources and nonpoint sources in Wisconsin. This strategy documents ongoing activities whether they are implemented by federal, state or local agencies. It identifies areas where further progress is needed.

This strategy is in part a response to two federal initiatives. The *Gulf Hypoxia Action Plan 2008,* developed and approved by representatives of a number of federal agencies and 12 states, calls for each agency and state in the Mississippi River Basin to develop a nutrient reduction strategy by 2013. The *Gulf Hypoxia Action Plan 2008* further calls for the strategies to target watersheds contributing the greatest amount of nutrients and to focus implementation where both local water quality needs and Gulf of Mexico needs can be met. Similarly, in March 2011, Nancy Stoner, Acting Assistant Administrator for Water for the U. S. Environmental Protection Agency (EPA,) released a memorandum encouraging EPA Regions to work with states to develop state nutrient reduction frameworks. That memo identifies and recommends eight elements essential to adequate state nutrient reduction programs. Neither of these initiatives call for EPA approval, although EPA may review and comment on the strategy. It also includes needs for the Great Lakes consistent with Annex 4 of the Great Lakes Water Quality Agreement of 2012.

While the federal initiatives are important, it is also important to develop a state Nutrient Reduction Strategy to meet water quality needs within Wisconsin to most effectively and efficiently coordinate resources. That is, incorporate needs associated with eliminating water quality problems in local impaired streams and lakes as well as in local drinking water. Within Wisconsin, about half of the streams and rivers do not meet water quality standards for phosphorus. Analysis of water quality data collected over more than three decades at 15 of 38 sites across the state show increases in nitrogen concentrations. In addition, many local public drinking water wells have concentrations exceeding or approaching the drinking water quality standard for nitrates. Many of these well owners are facing increased costs to remove nitrates.

Gulf Hypoxia Components and EPA Framework Elements

The Gulf Hypoxia Action Plan and the March 2011 EPA memo call for similar elements in the state reduction strategies or frameworks[2]. The Table I.1 below presents a comparison of the elements.

[2] For this document, "strategy" is used to mean both the Gulf Hypoxia Action Plan 2008 strategy and the March 2011 EPA memo framework.

State Nutrient Reduction Strategy Components and EPA Framework Elements[3]	
Essential Strategy Components Identified by States	**EPA Framework Elements**
Characterizing Watersheds and Identifying Nutrient Sources and Contributions	1. Prioritize Watersheds on a Statewide Basis for Nitrogen and Phosphorus Loading Reductions
Priority Setting	
Evaluating and Selecting Appropriate Analytical Tools	
Establishing Quantitative Reduction Targets	2. Set Watershed Load Reduction Goals Based upon Best Available Information
Establishing Current Status and Historical Trends	
Examining Current Regulations, Programs, and Policies	
Identifying and Documenting Appropriate Management Practices and Technical Assistance Programs (Input Management, Water Management, Proven and Innovative Nonpoint Source BMPs, Point Source Management)	3. Ensure Effectiveness of Point Source Permits in Targeted/Priority Sub-watersheds for WW facilities, CAFOs, and Urban Storm water
	4. Agricultural Areas
	5. Storm Water and Septic Systems
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Additional Strategy Components Identified by States	**EPA Framework Element**
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Effective Education and Outreach	
Tracking and Reporting Progress	7. Annual Public Reporting of Implementation Activities and Bi-annual Reporting of Load Reductions and Environmental Impacts Associated with Each Management Activity in Targeted Watersheds
Developing Numeric Nutrient Standards	8. Develop Work Plan and Schedule for Numeric Criteria Development

Figure I.1 Comparison between Gulf Hypoxia Task Force components and March 2011 EPA memo elements.

Development of Strategy

Although development of Wisconsin's Nutrient Reduction Strategy was coordinated by the Department of Natural Resources with assistance from the University of Wisconsin – Extension, the intent is to provide a brief compendium of federal, state and local programs being implemented in Wisconsin to reduce nutrients reaching surface waters and groundwater. To meet this intent, the strategy was developed with substantial input from staff of federal, state, and local agencies and stakeholders. It covers both point sources and nonpoint sources as well as both urban areas and rural areas.

[3] Gulf Hypoxia Coordinating Committee

This strategy was developed with the presumption that Wisconsin has many nutrient reduction programs in place and that we, as a state, are not "starting from scratch". This does not mean that program implementation is complete. Filling programmatic gaps and enhancing coordination were two areas of emphasis in developing this strategy. This strategy does not call for new regulations for either point sources or nonpoint sources.

It is anticipated that completion of an adequate state Nutrient Reduction Strategy will enable the state to be eligible for grants from EPA and other federal agencies. In the future, an adequate state Nutrient Reduction Strategy may also be necessary to maintain current grants to states, such as the section 319 nonpoint source management grant from EPA.

While this document attempts to represent current programs and activities, it is anticipated that periodic updates will be need to keep the document up-to-date. Updates will be part of the annual reports and presented at both public meetings and the nutrient reduction website: [specific site TBD following draft review].

Chapter 1. Targeting/Priority Setting

Element 1. Prioritize Watersheds on a Statewide Basis for Nitrogen and Phosphorus Loading Reductions

1.1 EPA and Gulf Hypoxia Task Force Expectations

1.1.1 Nutrient Reduction Framework Expectation:

From EPA's WQ-26 national performance measure:

States set priorities on a watershed or source-sector basis. States may also include a combination of watershed and sector approaches in prioritizations. State should set priorities reflecting each of the three following considerations:

- **Systematic and Data-Driven:** Prioritization of sub-watersheds (or water bodies) or source sectors should reflect a systematic evaluation based on available data concerning N and P loadings, high-risk receiving water problems, public and private drinking water supply impacts, or other environmental factors. States may: (a) identify watersheds in the state which are of highest priority, or (b) identify which key source sectors or sub-sectors are of highest priority (e.g., identifying which sectors could contribute the most near-term loading reductions, such as POTWs, industrial or municipal storm water, fertilizer usage, urban or rural BMPs, etc.). States are also encouraged to utilize an adaptive approach to priority setting; i.e., as new information is available, priorities may shift. Examples: Use the USGS SPARROW model to identify major watersheds or sectors that individually or collectively account for a substantial portion of loads (e.g. 80%) delivered to waters in a state or directly delivered to multi-jurisdictional waters. Or use the Recovery Potential Screening Tool (www.epa.gov/recoverypotential/) to screen potential nutrient load reductions.

- **Appropriate scale:** For setting watershed priorities, the state should use the scale (HUC 12, HUC 8, etc.) that is most appropriate for watershed management purposes. Within each major HUC 8 watershed that has been identified as accounting for a substantial portion of the load, identify targeted/priority sub-watersheds on a HUC 12 or similar scale where subsequent activities under the strategy will be focused. For setting priorities among source sectors, the state should use an appropriate level of source detail (e.g., sector or sub-sector) for watershed management purposes.

- **Inclusive:** The state should include all state waters and water body types for which it has data available, and/or all source sectors within the state for which it has data, in its priority-setting analysis. Example: Use SPARROW to estimate N & P loadings delivered to rivers, streams, lakes, reservoirs, etc. in each major watershed and/or from each source sector across the state.

The EPA encourages states to involve the public in their priority-setting approaches, or to make the priorities available to the public.

1.1.2 Gulf Hypoxia Task Force Essential Strategy Component

- Characterize watersheds and identify nutrient sources and contributions.
- Set geographic priorities

Sidebar: A note about watershed codes:

In this and other chapters we use the federal agency watershed code, the Hydrologic Unit Classification (HUC) system. The number of digits in the code increases as the size of the watershed decreases. In this document, 8-digit (HUC 8), 10-digit (HUC 10) and 12-digit (HUC 12) codes are used. The table below shows the number of HUCs in Wisconsin for each of these three commonly used levels.

Major Basin	HUC 8	HUC 10	HUC 12
Lake Superior	5	22	108
Lake Michigan	13	90	450
Mississippi River	32	256	1244
Total	50	368	1802

The average size of a HUC 10 in Wisconsin is about 150 square miles (100,000 acres) while the size of a HUC 12 is about 30 square miles (20,000 acres).

Since the federal delineation of HUC watersheds extends across state lines, a number of the HUCs have a very small area in Wisconsin with the smallest being less than 10 acres. These very small HUCs may be combined with adjoining HUCs in the analyses described in this chapter or not included in the analysis.

Figure 1.1 HUC 8 Watersheds in Wisconsin

1.2 Wisconsin's Approach

Major sectors of nutrient contributions to lakes and streams and groundwater in Wisconsin are generally considered to include:

- Publicly (e.g. municipal) and privately (e.g. industrial) owned wastewater treatment facilities[4];
- Permitted storm sewer systems that are separate from municipal systems(MS4s);
- Industrial storm sewer systems;
- Concentrated animal feeding operations (CAFOs);
- Non-permitted municipal storm sewer systems (smaller communities);
- Septic systems and other on-site disposal systems;
- Agricultural lands, including land contributing nutrients in runoff from croplands, animal lots, dry lots as well as leaching of nitrogen through soil profiles;
- Eroding stream banks; and
- Timber harvesting sites[5].

The relative importance of these different source sectors varies greatly by receiving lake or stream. In some watersheds, point sources may be the dominant source of nutrients, while in others nonpoint sources may dominate. From a statewide perspective, all are considered important. Wisconsin has federal, state or local programs in place to control nutrients -- particularly phosphorus – from each of these major sectors.[6] Targeting and priority setting based on watersheds recognizes these disproportionate nutrient contributions.

This chapter describes Wisconsin's approaches to targeting/priority setting in two sections. In the first section (1.2.1), a brief analysis of geographic extent of phosphorus sources is presented. In the second section (1.2.2), the top group of watersheds resulting from an analysis of modeling and monitoring information is summarized. Wisconsin state, federal and local agencies conducted a systematic and data driven analysis of nutrient contributions to geographically target watersheds. This should be considered as **an initial analysis** to be revisited and refined over time.

1.2.1. Geographic Extent of Nutrient Sources

Both EPA's Nutrient Reduction Strategy and the Gulf of Mexico Essential Strategy Components call for a characterization of watersheds and identification of nutrient contributions. EPA suggests identifying geographic locations for 80% of the nutrient contribution. Tables 1.1 and 1.2 show the nonpoint source phosphorus load (average pounds per year) for each of the HUC 8s in Wisconsin within the Mississippi River Basin and Lake Michigan Basin, respectively. In general, this simple analysis shows that much of the state that is not forested contributes to that 80% of the phosphorus load. Although some geographic areas contribute more per square mile or acre than others, it is not

[4] Includes management of application of biosolids to agricultural lands

[5] Generally considered as a source of sediment and not generally considered as a major source of phosphorus.

[6] The suite of regulatory and non-regulatory programs is described in other chapters of this report.

feasible to achieve large reductions in nutrient loads to downstream waters, such as the Mississippi River or Lake Michigan, by working only in small portions of the state.

Both of the tables were developed using USGS SPARROW (SPAtially Referenced Regressions On Watershed) model results for agricultural, urban, forested and other lands.[7] In the SPARROW analysis, urban storm water runoff nutrient contributions are included as nonpoint sources even for urban areas under the WPDES storm water permit program. Wastewater treatment facilities were not included in this simple analysis. However, both point sources and nonpoint sources are included in the analyses described in Chapter 2 (Element 2). The HUC 8 river basins are listed in the tables in decreasing order of phosphorus yield (average pounds per acre per year). Yields are a better indication of the significance of the contribution, while total load tends to be more a response to the size of the basin given the wide variation in basin size. It is presumed that nitrogen contributions follow a similar geographic distribution, but a future analysis is warranted when better point source and nonpoint source information is available.

For the Mississippi River Basin, the HUC 8 river basins in southwest Wisconsin (e.g. Grant – Platte River Basin and Sugar – Pecatonica River Basin) have the highest phosphorus yields and also rank at the top for phosphorus loads (pounds per year). The Upper Rock River Basin, the Lower Wisconsin River Basin, the Buffalo --Trempealeau River Basin, the Lower Chippewa River Basin and the Central Wisconsin River Basin, although having a lower yield, also contribute relatively large phosphorus loads due to the large geographic area of each of the basins.

For the Lake Michigan Basin, the Lower Fox River, Pensaukee River and combined Manitowoc – Sheboygan Rivers HUC 8 basins contribute the highest phosphorus yields. However, the Wolf River Basin due to its very large size contributes a substantial phosphorus load.

[7] Robertson, D. M., and Saad, D. A., 2011, Nutrient inputs to the Laurentian Great Lakes by source and watershed estimated using SPARROW watershed models: Journal of the American Water Resources Association. V. 47, p. 1011-1033, DOI: 10.1111/j.1752-1688.2011.00574.x.

Table 1.1 Nonpoint Source Phosphorus Contributions for the **Mississippi River Basin** – By HUC 8

Mississippi River Basin 8-digit HUC	DNR Basin	Nonpoint Source yield (lb/a/yr)	Nonpoint Source Load (lb/yr)	Cum. Total (lb/yr)	% of total	Cum % of Total
Grant- Maquoketa	Grant-Platte	0.99	499,755	499,755	6.8%	6.8%
Pecatonica River	Sugar – Pec	0.88	642,667	1,142,423	8.8%	15.6%
Apple-Plum Rivers	Grant-Platte	0.74	82,735	1,225,158	1.1%	16.7%
Coon-Yellow Rs	Bad Axe – LaX	0.59	254,458	1,479,616	3.5%	20.2%
Des Plaines River	SE Fox	0.51	44,392	1,524,009	0.6%	20.8%
Sugar River	Sugar – Pec	0.49	216,708	1,740,717	3.0%	23.7%
Kickapoo River	Lower Wis	0.47	229,545	1,970,262	3.1%	26.9%
Upper Rock River	Upper Rock	0.46	401,250	2,607,935	5.5%	32.3%
Baraboo River	Lower Wis	0.45	186,795	2,794,730	2.5%	34.9%
Buff-Whitewater	Buffalo-Tremp	0.44	206,814	3,001,544	2.8%	37.7%
Rush-Vermillion Rs	Lo Chippewa	0.37	121,479	3,123,023	1.7%	39.4%
Lower Wisconsin R	Lower Wis	0.36	538,274	3,661,298	7.3%	46.7%
Trempealeau River	Buffalo-Tremp	0.35	527,810	4,189,108	7.2%	53.9%
Black River	Black	0.33	477,914	4,667,022	6.5%	60.4%
La Crosse-Pine Rs	Bad Axe - La X	0.31	119,466	4,786,488	1.6%	62.1%
Lake Dubay	Central Wis	0.30	519,094	5,305,582	7.1%	69.1%
Eau Claire River	Lo Chippewa	0.25	138,624	5,444,206	1.9%	71.0%
Lower Chippewa R	Lo Chippewa	0.24	317,434	5,761,639	4.3%	75.4%
Upper Fox River	SE Fox	0.23	136,103	5,897,742	1.9%	77.2%
Red Cedar River	Lo. Chippewa	0.22	268,346	6,166,088	3.7%	80.9%
Lower Rock River [#]	Lower Rock	0.19	236,423	2,206,685	3.2%	84.1%
Lower St. Croix R	St. Croix	0.19	209,114	6,728,886	2.9%	87.0%
Jump River	Up. Chippewa	0.19	105,681	6,834,567	1.4%	88.4%
Castle-Rock	Central Wis	0.17	353,684	6,519,772	4.8%	93.2%
Upper Chippewa R	Up Chippewa	0.13	161,258	6,995,825	2.2%	95.4%
Upper St. Croix R	St. Croix	0.10	99,276	7,095,101	1.4%	96.8%
Namekagon River	St. Croix	0.08	49,827	7,144,928	0.7%	97.5%
Flambeau River	Up Chippewa	0.08	61,762	7,206,690	0.8%	98.3%
So Fk Flambeau R	Up Chippewa	0.08	39,125	7,245,815	0.5%	98.8%
Up Wisconsin R	Up Wisconsin	0.06	85,220	7,331,035	1.2%	100.0%

[#] Note: Lower Rock River data also includes Kishwaukee River and Piscasaw Creek 8-digit HUCs

Table 1.2 Nonpoint Source Phosphorus Contributions for the **Lake Michigan Basin** – By HUC 8 Watershed

Lake Michigan Basin 8-digit HUC	DNR Basin	Nonpoint Source yield (lb/a/yr)	Nonpoint Source Load (lb/yr)	Cumm. Total (lb/yr)	% of total	Cumm. % of Total
Lower Fox	Lower Fox	0.65	270,672	270,672	10.6	10.6%
Pensaukee	Green Bay	0.63	133,995	404,666	5.3	15.9%
Manitowoc - Sheboygan	Manitowoc & Sheboygan	0.58	458,625	863,291	18.0	33.9%
L Winnebago	Upper Fox	0.48	114,353	977,644	4.5	38.4%
Door-Kewaunee	Twin-Door-Kewaunee	0.45	221,589	1,199,233	8.7	47.1%
Pike-Root	Southeast	0.44	94,562	1,293,795	3.7	50.8%
Milwaukee	Milwaukee	0.38	212,662	1,506,457	8.4	59.2%
Upper Fox	Upper Fox	0.22	229,076	1,735,533	9.0	68.2%
Wolf River	Wolf	0.21	489,918	2,225,451	19.2	87.4%
Oconto River	Green Bay	0.20	125,579	2,351,030	4.9	92.3%
Brule River	Green Bay	0.12	14,577	2,365,606	0.6	92.9%
Peshtigo	Green Bay	0.11	85,594	2,451,201	3.4	96.3%
Menominee	Green Bay	0.11	94,861	2,546,061	3.7	100.0%

1.2.2. Geographic Targeting/Priority Setting

For purposes of targeting and priority setting, HUC 10 watersheds currently provide the best match with available modeling and water quality information; even though the HUC 12 is more suitable for implementation projects. In general, analysis at the HUC 12 level would require more sophisticated modeling and water quality monitoring at many more streams or groundwater locations. Future efforts will move toward developing a HUC 12 analysis to better serve implementation project selection.

An initial suite of "top group" HUC 10 watersheds were identified through a data-driven, systematic analysis. Top groups were identified separately for the Mississippi River Basin and for the Lake Michigan Basin. Within each major basin, top groups were identified separately for phosphorus concerns and nitrogen concerns in surface waters. An initial statewide analysis of nitrogen concerns in groundwater was also conducted.

It is anticipated that the top groups of HUC 10 watersheds listed in this section will be used to help select future implementation nonpoint source projects, such as for the Mississippi River Basin Initiative (USDA – NRCS), Environmental Quality Incentives Program (EQIP) (USDA – NRCS) and the Great Lakes Restoration Initiative. Several additional factors, such as local interest and capability; likelihood for the water to respond; coordination with other implementation activities; and availability of water quality monitoring data, will also be considered in future implementation project selection. These top group HUC 10 watersheds may also be used in setting priorities for implementation programs. For example, Wisconsin federal, state and local agencies may focus water quality monitoring, technical assistance or other management tools in these watersheds.

This initial analysis uses a multiple lines of evidence approach. In such an approach, if multiple lines of evidence (e.g., SPARROW model results and monitored concentrations) identify the same top HUC 10s, there should be a high level of confidence that those HUC 10s are among the highest contributors. If different lines of evidence give substantially different rankings, then those HUC 10s are not necessarily in the top group. This is not meant to infer that any of the lines of evidence are in error, since they may measure or predict different parameters. In future analyses, it is anticipated that additional lines of evidence will be incorporated, such as likelihood of the lake or stream to respond to reduced nutrient loads.

A summary of information on each of the HUC 10 watersheds is included in Table A.1 of Appendix A. As shown on Figures 1.2 and 1.3, the HUC 10 watersheds tend to form clusters based on common land use, soils and topography. HUC 10 watersheds in the Lake Superior Basin would compare to the bottom half of watersheds in the Lake Michigan and Mississippi River Basin. Information on these Lake Superior Basin HUC 10 watersheds is included in Table A.1. Table A.1 also contains the following information:

- Percent agricultural and urban use
- Point source – nonpoint source phosphorus load ratio (identified by PRESTO model)
- The inclusion of the watershed in an EPA approved TMDL
- The presence of an Outstanding Resource Water or Exceptional Resource Water in or "touching" the watershed

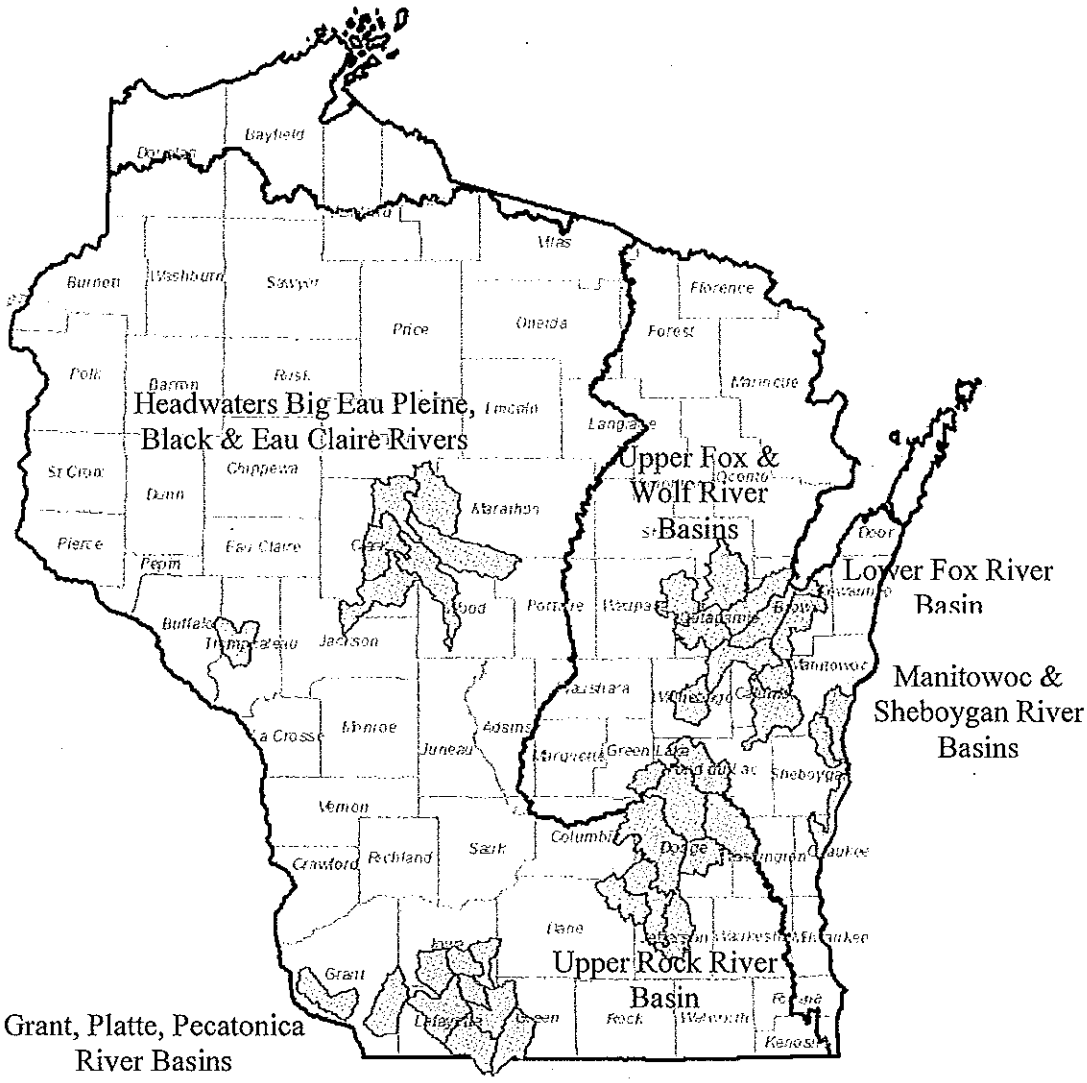

Figure 1.2 Top Group HUC 10 Watersheds for Phosphorus

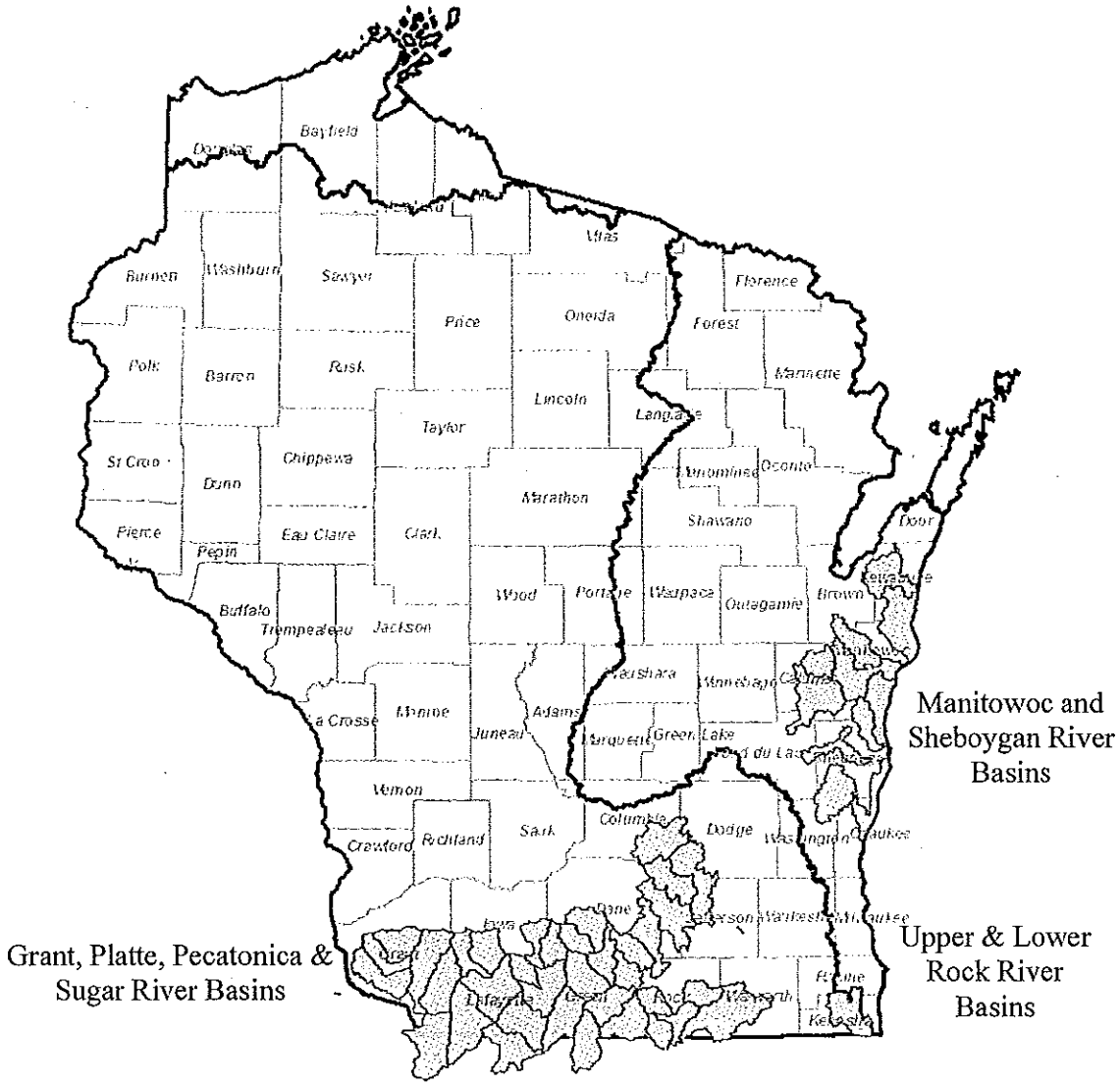

Figure 1.3 Top Group HUC 10 Watersheds for Nitrogen

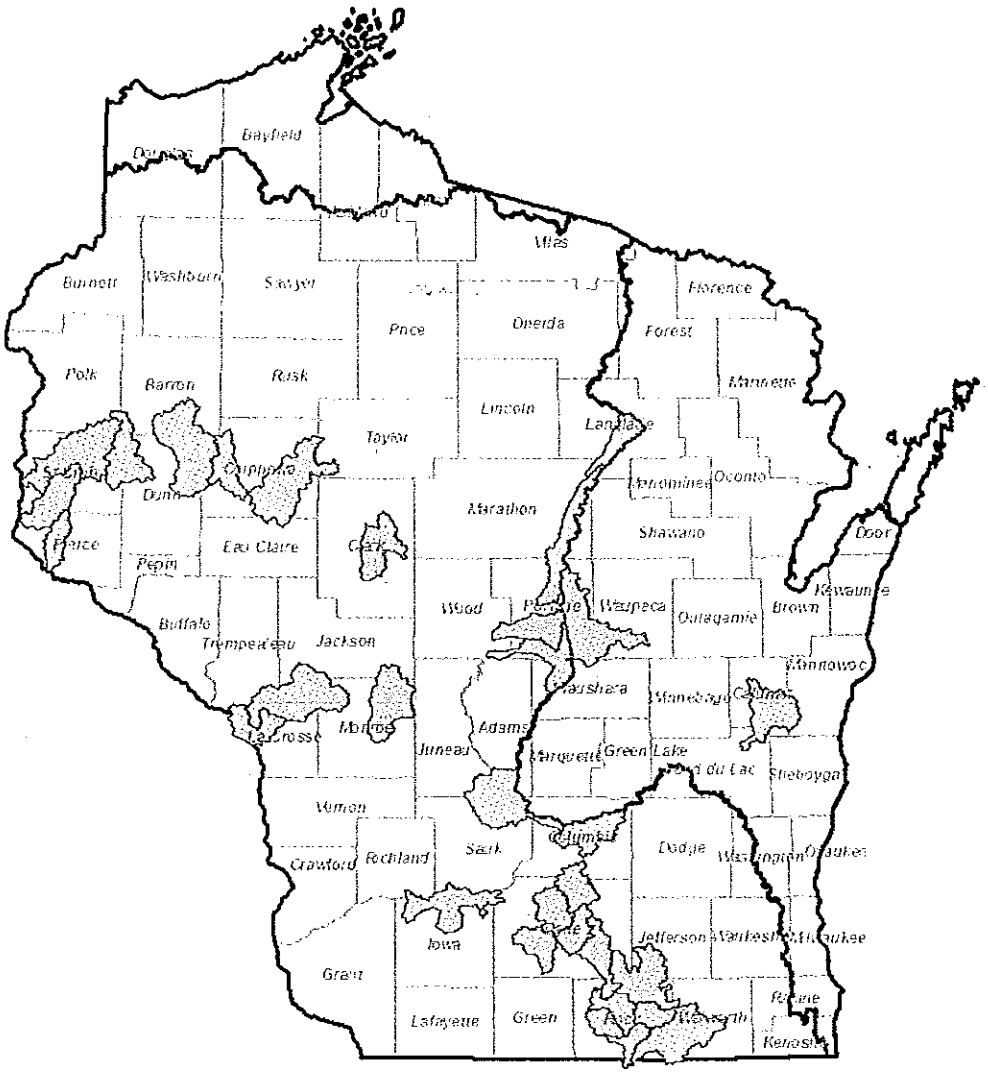

Figure 1.4 Top Group Safe Drinking Water - Nitrates

Mississippi River Basin Top Groups

Phosphorus – Surface Waters

Watersheds were analyzed according to SPARROW model incremental yields and median stream concentrations of phosphorus monitored during the growing season. The top group HUC 10 watersheds listed below comprises about 10% of the HUC 10 watersheds in the Mississippi River Basin. They are either:

- The top 20% for <u>both</u> SPARROW incremental yield modeling and stream monitoring growing season concentrations.

- The top 10% of either SPARROW incremental yield modeling or stream monitoring growing season concentrations and the top 30% for the other.

Headwaters of the Big Eau Pleine River, Yellow River and the Black River in western Marathon County, Wood County and Clark County.

0704000702	Popple River
0704000704	Rock Creek-- Black River
0707000215	Dill Creek – Big Eau Pleine River
0707000217	Little Eau Pleine River
0707000311	Rocky Creek – Yellow River

Watersheds in southwestern Wisconsin south of Military Ridge, including those in the Grant-Platte and Sugar-Pecatonica River basins.

0706000303	Lower Grant River
0706000304	Little Platte River
0709000301	Mineral Point Branch
0709000303	Ames Branch – Pecatonica River
0709000304	Dodge Branch
0709000306	Ridgeway Branch – Pecatonica River
0709000307	Yellowstone River
0709000308	East Branch Pecatonica River
0709000309	Spafford Creek – Pecatonica River
0709000310	Honey Creek – Pecatonica River

Watersheds in the Rock River Basin[8]

0709000101	East Branch Rock River
0709000102	West Branch Rock River – Rock River
0709000104	Sinissippi Lake – Rock River
0709000108	Maunesha River
0709000109	Beaver Dam River
0709000110	Crawfish River
0709000111	Johnson Creek – Rock River

Others

0704000504	Middle Trempealeau River
0704000709	Lake Arbutus – Black River

[8] The two HUC 10s draining to Lake Mendota are ranked lower due to the SPARROW analysis where the analytical watershed is at the outlet of Lake Mendota and not at locations entering the lake. In the Rock River TMDL analysis where the SWAT Model was used, these two HUC 10s ranked in the top five HUC 10s in the basin. It is not clear whether as a result of a revised SPARRROW analysis that these two HUC 10s would be in the top group. See sidebar.

SIDEBAR: Nutrients in Lake Mendota and the Yahara River Watershed

Multiple efforts over many years have contributed to understanding of sediment and nutrient transport within the Yahara Watershed and ongoing refinement and calibration of nutrient loading models. Analysis consistently identifies the Lake Mendota-Yahara River Watershed (HUC10-0709000206) as a major source of nutrient loading within the Yahara Watershed (see references listed below). Those studies have led to substantial investment of resources and the development of Dane County ordinances to address nutrient losses.

References

- Wisconsin Department of Natural Resources: Bureau of Water Resources Management-Nonpoint Source and Land Management Section. (1997). *Nonpoint Source Control Plan for the Lake Mendota Priority Watershed Project.* Retrieved from http://www.countyofdane.com/lwrd/landconservation/papers/Lmw.pdf on May 28, 2013.
- Strand Associates, Inc. (2008). *Community Manure Management Feasibility Study.* Madison, WI:
- Yahara CLEAN Memorandum of Understanding Signatories. (2010). *A CLEAN Future for the Yahara Lakes: Solutions for Tomorrow, Starting Today.* Madison, WI: Sue Jones, Sue Josheff, Dennis Presser, Genesis Steinhorst. Retrieved from http://www.yaharaportal.org/sites/default/files/CLEAN_Report_090910.pdf on May 28, 2013.
- Montgomery Associates Resource Solutions, LLC. (2011). *Yahara CLEAN Non-Point Source Modeling Report for the Dane County Department of Land and Water Resources.* Cottage Grove, WI:
- UW-Extension. (2012). *Farm Practices in the Lake Mendota Watershed: A Comparative Analysis of 1996 and 2011.* Madison, WI: Ken Genskow & Carolyn Rumery Betz. Retrieved from http://www.yaharaportal.org/sites/default/files/MendotaFPIReporFINALJune2012.pdf on May 28, 2013.
- Strand Associates, Inc. (2012). *Yahara CLEAN Implementation Plan.* Madison, WI:
- Strand Associates, Inc. (2013). *Yahara CLEAN Engineering Report.* Madison, WI:
- Lathrop, R. C. (2007). Perspectives on the eutrophication of the Yahara lakes. *Lake and Reservoir Management* 23:345-365.
- Lathrop, R. C. and S. R., Carpenter. (2011). Phosphorus Loading and Lake Response Analysis for the Yahara Lakes. Pending publication.

Nitrogen – Surface Waters

Watersheds were analyzed according to SPARROW model incremental yields and median stream concentrations of total nitrogen monitored during the growing season. The top group HUC 10 watersheds listed below comprises about 15% of the HUC 10 watersheds in the Mississippi River Basin. Many of those listed are also listed for phosphorus above, but a few, such as Blackhawk Creek, are ranked very high for nitrogen but not for phosphorus. Watersheds in Marathon, Clark and Taylor Counties listed above for phosphorus, do not come out as high for nitrogen. Due to similar overall results, a larger list for nitrogen than the list for phosphorus is appropriate. The HUC 10 watersheds are listed based on being in either:

- the top 20% for both SPARROW incremental yield modeling and stream monitoring growing season concentrations.
- the top 10% of either SPARROW incremental yield modeling or stream monitoring growing season concentrations and the top 30% for the other.

Watersheds in southwestern Wisconsin south of Military Ridge, including those in the Grant-Platte and Sugar-Pecatonica river basins.

0706000301	Upper Grant River
0706000302	Middle Grant River
0706000303	Lower Grant River
0706000304	Little Platte River
0706000305	Platte River
0706000502	Sinsinawa River – Mississippi River
0706000503	Galena River
0706000505	South Fork Apple River – Apple River
0709000301	Mineral Point Branch
0709000302	Headwaters Pecatonica River
0709000303	Ames Branch – Pecatonica River
0709000305	Blue Mounds Branch
0709000306	Ridgeway Branch – Pecatonica River
0709000307	Yellowstone River
0709000308	East Branch Pecatonica River
0709000309	Spafford Creek – Pecatonica River
0709000310	Honey Creek – Pecatonica River
0709000311	Richland Creek
0709000315	Raccoon Creek
0709000401	West Branch Sugar River
0709000402	Headwaters Sugar River
0709000403	Allen Creek
0709000404	Little Sugar River
0709000405	Story Creek – Sugar River
0709000406	Sylvester Creek – Sugar River
0709000407	Taylor Creek – Sugar River

Watersheds in the Rock River

0709000107	Headwaters Crawfish River
0709000108	Maunesha River
0709000110	Crawfish River
0709000204	Koshkonong Creek
0709000208	Badfish Creek
0709000209	Lake Kegonsa – Yahara River
0709000211	Blackhawk Creek
0709000212	Bass Creek
0709000214	Turtle Creek
0709000215	City of Beloit – Lower Rock River

Others

0712000401	Headwaters Des Plaines River

Nitrogen – Drinking Water/Groundwater

HUC 10 watersheds with higher nitrogen levels in well water compared to other watersheds in Wisconsin were identified statewide basis. The analysis included both the number and percent of public wells with nitrate concentrations of 5 mg/L or greater. The threshold of 5 mg/L was chosen as being well within the range of "human activity influenced" groundwater degradation for this nutrient, and is also thought to place the public system at greater risk of exceeding the enforcement standard of 10 mg/L. The top 10% of HUC 10 watersheds statewide are considered as the top group, and comprise about 12% of the HUC 10s in the Mississippi River Basin.

The HUC 10 watersheds of the top group located within the Mississippi River Basin in order of HUC 10 number are:

0703000510	Willow River
0703000511	Kinnickinnic River
0704000103	Trimbelle River
0704000601	Halfway Creek – Mississippi River
0704000704	Rock Creek – Black River
0704000712	Fleming Creek – Black River
0705000503	Lake Wissota
0705000504	Duncan Creek
0705000705	Lake Chetek
0705000707	Lower Pine Creek – Red Cedar River
0707000211	Spring Brook
0707000301	Plover River
0707000304	Fourmile Creek
0707000305	Tenmile Creek
0707000315	Upper Lemonweir River
0707000319	Dell Creek – Wisconsin River
0707000501	Duck Creek – Wisconsin River
0707000512	City of Spring Green – Wisconsin River
0709000205	Headwaters Yahara River
0709000206	Lake Mendota – Yahara River
0709000207	Lake Monona – Yahara River
0709000209	Lake Kegonsa – Yahara River
0709000210	Lake Koshkonong – Rock River
0709000211	Blackhawk Creek
0709000212	Bass Creek
0709000213	Marsh Creek – Rock River
0709000214	Turtle Creek
0709000215	City of Beloit – Lower Rock River
0709000402	Headwaters Sugar River

Lake Michigan Basin Top Groups

Watersheds in the Lake Michigan Basin were analyzed for phosphorus and total nitrogen in surface waters and nitrogen in drinking water/groundwater in the same manner used for the Mississippi River Basin.

Phosphorus – Surface Waters

Those HUC 10s listed below comprise about 16% of the HUC 10s in the Lake Michigan Basin.

Watersheds in the Manitowoc and Sheboygan River Basins.

0403010103	North Branch Manitowoc River
0403010104	South Branch Manitowoc River
0403010107	Sevenmile & Silver Creeks – Frontal Lake Michigan
0403010108	Pigeon River
0403010112	Black R, Sauk Cr and Sucker Cr – Frontal L. Mich.

Watersheds in the Lower Fox River Basin.

0403020401	Duck Creek – Frontal Green Bay
0403020402	Plum Creek – Fox River
0403020403	East River
0403020404	Fox River – Frontal Green Bay (Apple – Ashwaubenon-Dutchman Creeks)

Watersheds surrounding or west of Lake Winnebago.[9]

0403020104	Upper Grand River
0403020112	Lake Butte des Mortes
0403020208	Shioc River
0403020213	Bear Creek – Embarrass River
0403020214	Bear Creek – Wolf River.
0403020302	Fond du Lac River

Nitrogen – Surface Waters

Those HUC 10s listed below comprise about 13% of the HUC 10s in the Lake Michigan Basin. Many of those listed are also listed for phosphorus above.

Watersheds in the Manitowoc, Sheboygan and Milwaukee River Basins.

0403010101	East Twin River – Frontal Lake Michigan
0403010103	North Branch Manitowoc River
0403010104	South Branch Manitowoc River
0403010105	Branch River
0403010106	Manitowoc River – Frontal Lake Michigan
0403010107	Sevenmile & Silver Creeks – Frontal Lake

[9] The relative rank of these watersheds would be lower if the "delivered" SPARROW results are used where trapping of phosphorus within Lake Winnebago is incorporated.

	Michigan
0403010108	Pigeon River
0403010109	Mullet River
0403010112	Black R, Sauk Cr and Sucker Cr – Frontal L. Mich.
0403010203	Kewaunee River
0404000301	North Branch Milwaukee River

Nitrogen – Drinking Water/Groundwater

The top 10% statewide are considered as the top group, and comprise about 2% of the HUC 10s in the Lake Michigan Basin. The HUC 10 watersheds of the top group located within the Lake Michigan Basin are:

0403010104	South Branch Manitowoc River
0403020218	Waupaca River

1.2.3 Models and Monitoring Data.

For this data-driven analysis, results from the USGS SPAtially Referenced Regressions On Watershed attributes (SPARROW) model, DNR Watershed Rotation Water Quality Monitoring (aka "pour point") data, and public drinking water systems well data were used as follows:

- USGS SPARROW Model[10] -- This model was used for this analysis since it consistently provided both phosphorus and nitrogen load information. "Incremental" nonpoint phosphorus and nitrogen yield results from the MRB3 SPARROW models (Robertson and Saad 2011) were aggregated at the HUC 10 level. Yields are expressed in average annual pounds per acre per year over several years centered around 2002, because these values are not influenced by the size of the watershed. Use of the "incremental" yield rather than the "delivered" incremental yield to downstream receiving waters places greater emphasis on local waters rather than on downstream waters, such as the Mississippi River and Gulf of Mexico.
- DNR watershed "pour point" monitoring concentrations data set – DNR collected water quality samples once per month during one year throughout the 2006-2011 period at the downstream location "pour point" of about 330 delineated watersheds on a rotating basis (50 to 60 per year. Median growing season (May through October) concentrations were used in this analysis. A minimum of four samples were needed to compute the median value. If an adequate number of samples were not available, other data specific to the watershed were used and shown in brackets in the HUC 10 table in Appendix A.
- Safe Drinking Water Nutrient Impacts – The prevalence of wells in the public drinking water supply systems reporting well water results of 5 mg/L or greater for nitrate were used as an approximate indicator that groundwater quality within the watershed shows evidence of significant nutrient impact. Two factors were considered jointly; the frequency of occurrence and the ratio of impacted wells to total active public drinking water systems located in the

[10] For more information on SPARROW modeling, see http://wi.water.usgs.gov/rna/9km30/index.html

HUC 10 watershed. Each impacted groundwater well is counted only once for the ten year period from 2003-2012..

1.2.4 Urban Watersheds

The analysis of the SPARROW model results described above did not include the municipal and industrial wastewater facility contribution identified with SPARROW for a number of reasons. Federal funding programs are likely to focus on agricultural nonpoint source management and there isn't a creditable point source nitrogen data set. However, if these wastewater point source phosphorus discharges were included, the SPARROW incremental and delivered phosphorus yields would change greatly for a small number of HUC 10 watersheds.

In the Mississippi River Basin:

- Pine Creek – Mississippi River (0704000605) due to the presence of the La Crosse wastewater facility,
- Lake Kegonsa – Yahara River (0709000209),
- Marsh Creek – Rock River (0709000213) due to the Janesville facility, and
- City of Winona – Mississippi River (0704000306) due to Winona Minnesota and other facilities

- In the Lake Michigan Basin: Pike River (0404000204).

1.2.5 Targeting within Watersheds

Although this chapter focuses on targeting watersheds for implementation funding and management activities, it is also important to recognize the Wisconsin efforts to identify critical sources areas and to target implementation activities within these watersheds. This is especially important for management of phosphorus where the majority of the phosphorus load may come from less than one-third of the croplands and from concentrated sources, such as animal lots. In many areas steeply sloped "dry lots" where livestock are located in close proximity to intermittent channels may be some of the most significant sources. Wisconsin is committed to continuing work to identify and understand management in critical source areas and their role in targeting within watersheds.
A research project in the Pleasant Valley watershed located in southwest Wisconsin, has found that about 12% of the crop and pasture lands have a P Index above 6 and contribute about a third of the phosphorus load from these agricultural lands. In addition, managing those fields so that a P Index of 6 is attained will reduce the phosphorus load by about 14%. Managing all fields above a P Index of 3 to 3 would reduce loads by 35%. (L. Ward Good, personal communication)

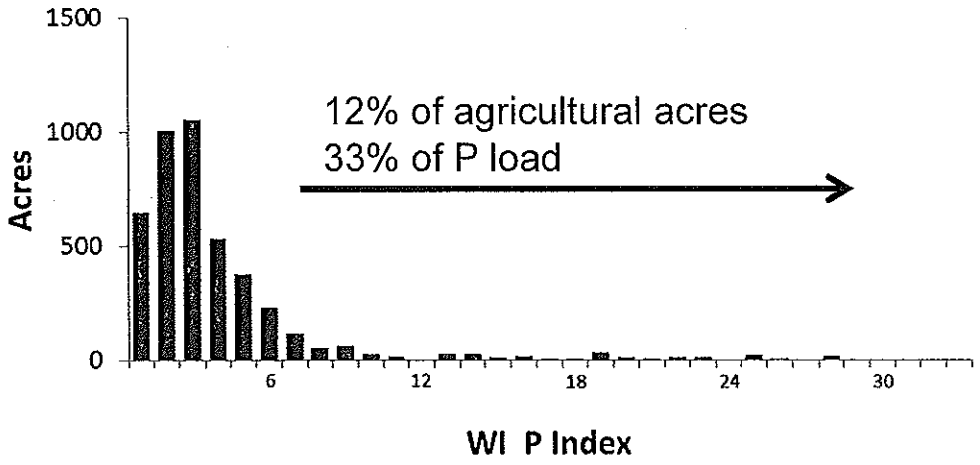

Figure 1.5 P Index values from cropland and pastures in the Pleasant Valley watershed (does not include grazed woods). Source: UW-Madison Soils.

Several other elements of this strategy also address targeting within priority watershed areas, including Chapter 4 Agricultural Nonpoint source Nutrients, Chapter 7 Accountability and Verification Measures and Chapter 8 Water Quality Monitoring.

1.3 Future Directions

Members of the multi-agency work group identified the following future directions:

1. Additional Information for Identifying Target and Priority Areas

   In future analyses, it is anticipated that additional lines of evidence, such as likelihood of the stream or lake to respond to nutrient reductions, will be also incorporated.

2. Move toward an analysis at the HUC 12 level.

   Since much of the nonpoint source implementation will take place at the HUC 12 level, it is desirable to move toward a systematic and data driven analysis at that watershed scale. This will allow variation within HUC 10 watersheds to be considered. For example, the Big Green Lake HUC 10 watershed has a wide range of topography from very flat areas in its eastern part to steeply sloped areas in its southern part. Overall, it does not rank high based on this initial analysis. However, an analysis at the HUC 12 level could result in the southern watershed areas ranking high.

   A systematic data driven analysis would, however, require further sophistication in modeling and additional monitoring. Further sophistication in modeling may include

defining all model inputs at smaller than a county level, incorporation of soil groupings and bedrock geology.

3. Incorporation of information from the Healthy Watersheds Initiative.

   The Wisconsin DNR is currently conducting a Healthy Watersheds Initiative assessment to rank watersheds on scales of health and vulnerability. These rankings may be used to target appropriate funding, focus management practices, promote protection through education and assess trends. Incorporation of this assessment could allow targeting on both a restoration and protection basis.

Chapter 2. Setting Nutrient Reduction Targets

Element 2. Set Watershed Load Reduction Goals Based Upon Best Available Information

2.1 EPA and Gulf Hypoxia Task Force Expectations

2.1.1 Nutrient Reduction Framework Expectation

From EPA's WQ-26 national performance measure:

1. Develop a methodology to evaluate the nitrogen and phosphorus loadings from all sectors.

2. Establish numeric goals for loading reductions that will likely be needed to meet water quality goals. States may opt to submit a schedule of load reduction targets within interim goals.

Quoting from the recommended elements, "[load reduction] goals should be based upon best available physical, chemical, biological, and treatment/control information from local, state, and federal monitoring, guidance, and assistance activities including implementation of agriculture conservation practices, source water assessment evaluations, watershed planning activities, water quality assessment activities, Total Maximum Daily Loads (TMDL) implementation, and National Pollutant Discharge Elimination System (NPDES) permitting reviews." For the protection of watersheds that are not impaired, instead of setting load reduction needed to meet water quality goals, the states may determine an alternative baseline for setting load reduction goals.

Load reduction goals may be set using, for example, any of the three considerations below:

- Pounds of total phosphorus and/or pounds of total nitrogen;
- Percentage of downstream pour point goal or targeted sector estimated loadings; and
- Water quality standards-based calculation based on flow/volume.

2.1.2 Gulf Hypoxia Task Force Essential Strategy Component

- Evaluate and select analytical tools
- Establish current status and trends
- Establish quantitative reduction targets

2.2 Wisconsin's Approach

As illustrated in the Table 2.1, Wisconsin's federal, state and local programs use a mixture of approaches to meet water quality standards, restore impaired waters, protect interstate downstream waters, protect high quality waters and minimize contaminants reaching groundwater. The specific

programs and their implementation progress are described in subsequent elements of this strategy. The purpose of this chapter is to relate the primary program features to identified water quality goals. Specifically, this chapter describes the following:

- Analytical tools
- Current status
- Nutrient trends
- Attaining the 45% phosphorus and nitrogen load reductions to the Mississippi River and Gulf of Mexico.
- Estimating phosphorus load reduction to Lake Michigan.
- Water quality- based effluent limits for municipal and industrial wastewater facilities. (See description of point source requirements in Chapter 3)
- Wasteload and load reductions identified in EPA-approved TMDLs.

2.2.1 Analytical Tools

In developing this strategy a number of analytical tools were used primarily and fall into three groups: analysis of stream, river and well monitoring data; results of modeling and compilations of point source discharge concentrations. The following is a brief description of the analytical tools, why they were selected, how they were used and how they may be used in the future.

- Stream, river and well water monitoring data

  Stream, river and well water river monitoring data was used to provide an analysis of the current status of nutrient related water quality in Wisconsin (section 2.2.2 of this chapter), determine which waters are considered impaired under section 303(d) of the Clean Water Act, rank watersheds for targeting future actions (Chapter 1), determining trends (section 2.2.3 of this chapter), measuring and reporting progress (Chapters 8 and 9). Three sets of monitoring data were primarily used in developing this strategy. The first set is data collected at the downstream "pour point" of over 300 watersheds (about HUC 10 watershed size). At each site, data was collected monthly for a 12-month period. Between50 and 60 watersheds were monitored each year from 2006 through 2011. The second set is data collected monthly for a number of decades at long-term river trend sites across the state. Data from these sites was used to conduct the trend analysis summarized in section 2.2.4 and will be part of Wisconsin's approach for measuring progress. The third set is public well monitoring data from wells across the state. Data from these wells was used in the targeting/priority setting analysis in Chapter 1 of this strategy.
- Modeling

  Models are used extensively in nutrient management in Wisconsin with the specific model tied to the specific use. For example, the nutrient model SNAP+ is frequently used to develop cropland nutrient management plans. Total maximum daily load analyses may use a variety of models including the Soil and Water Assessment Tool (SWAT) to estimate nutrient loads reaching streams.

In preparing this strategy, the SPARROW model (see Chapter 1) was used in a number of analyses. SPARROW model results were used to estimate phosphorus and nitrogen yield and loads for HUC 8 watersheds in Chapter 1 and for targeting HUC 10 watersheds also in Chapter 1. SPARROW was selected for these analyses because it provides information for both phosphorus and nitrogen, is available for both the Mississippi River and Great Lakes Basins, is calibrated based on monitoring data and has had extensive review. For future modeling, all available models, including enhanced versions of SPARROW, will be considered.

- Discharge Monitoring Reports and Watershed Project Research Results
  Analyses in this strategy also made extensive use of discharge monitoring report information from hundreds of municipal and industrial wastewater facilities and research results from nonpoint source implementation research projects.

2.2.2 Current Status

The current status of Wisconsin's waters is illustrated by the maps in Figures 2.1, 2.2 and 2.3. For total phosphorus, Figure 2.1 shows about half of the monitoring sites meet the water quality standards criteria and about half of the sites exceed the criteria. The criterion for streams is 0.075 mg/L (75 *u*g/L) and the criterion for rivers is 0.100 mg/L (100 *u*g/L). Figure 2.2 shows the total nitrogen concentrations for these same sites. No water quality standards criteria have been adapted for total nitrogen. See Chapter 10 of this strategy for more information.

Figure 2.3 shows the locations of public (use) drinking water wells across the state. The non-community public wells include restaurants, bars, schools, etc. The drinking water quality standard is 10 mg/l for nitrate and the preventive action level is 2 mg/L.

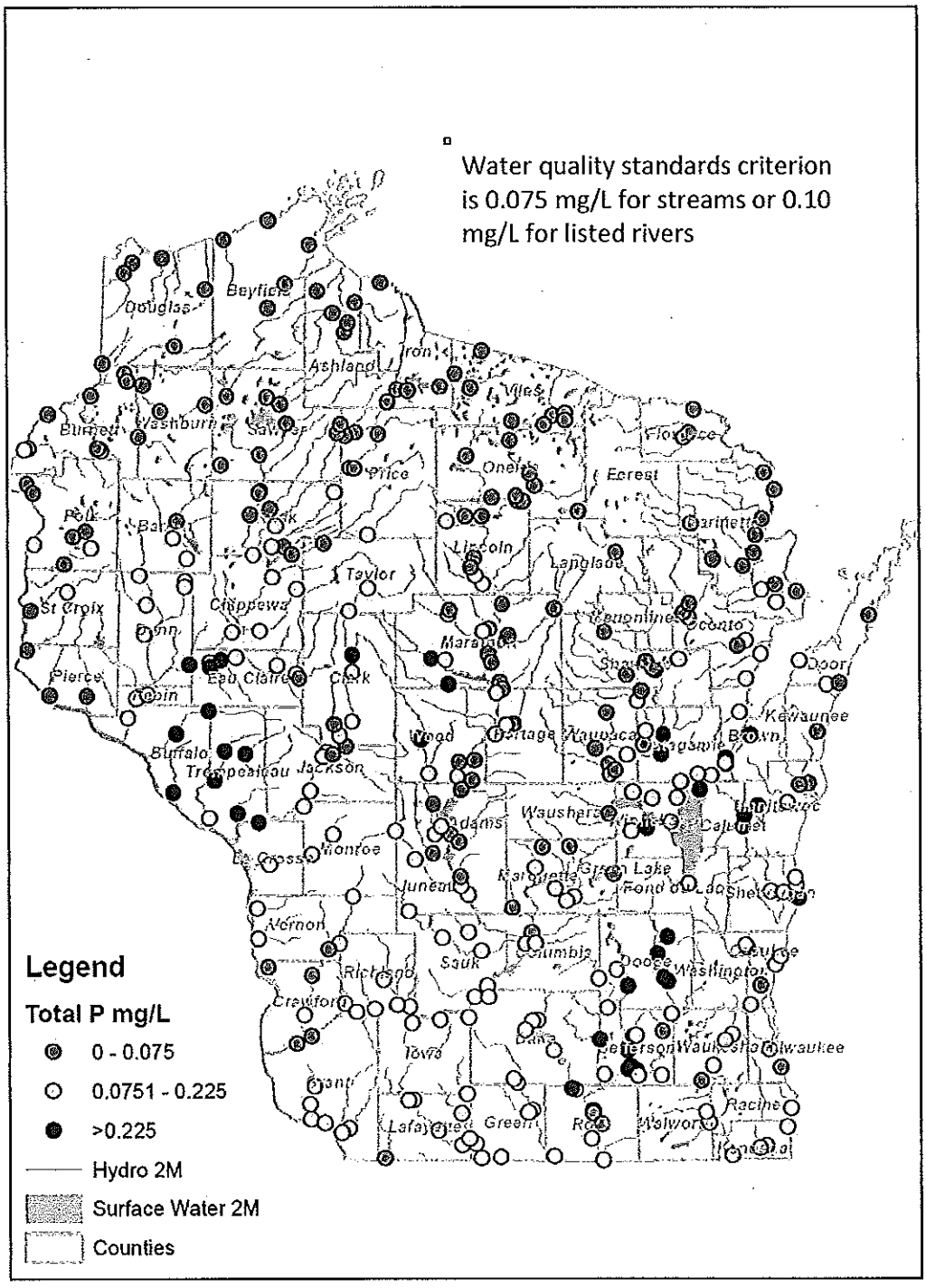

Figure 2.1 Stream Phosphorus Concentrations (Median May-October)

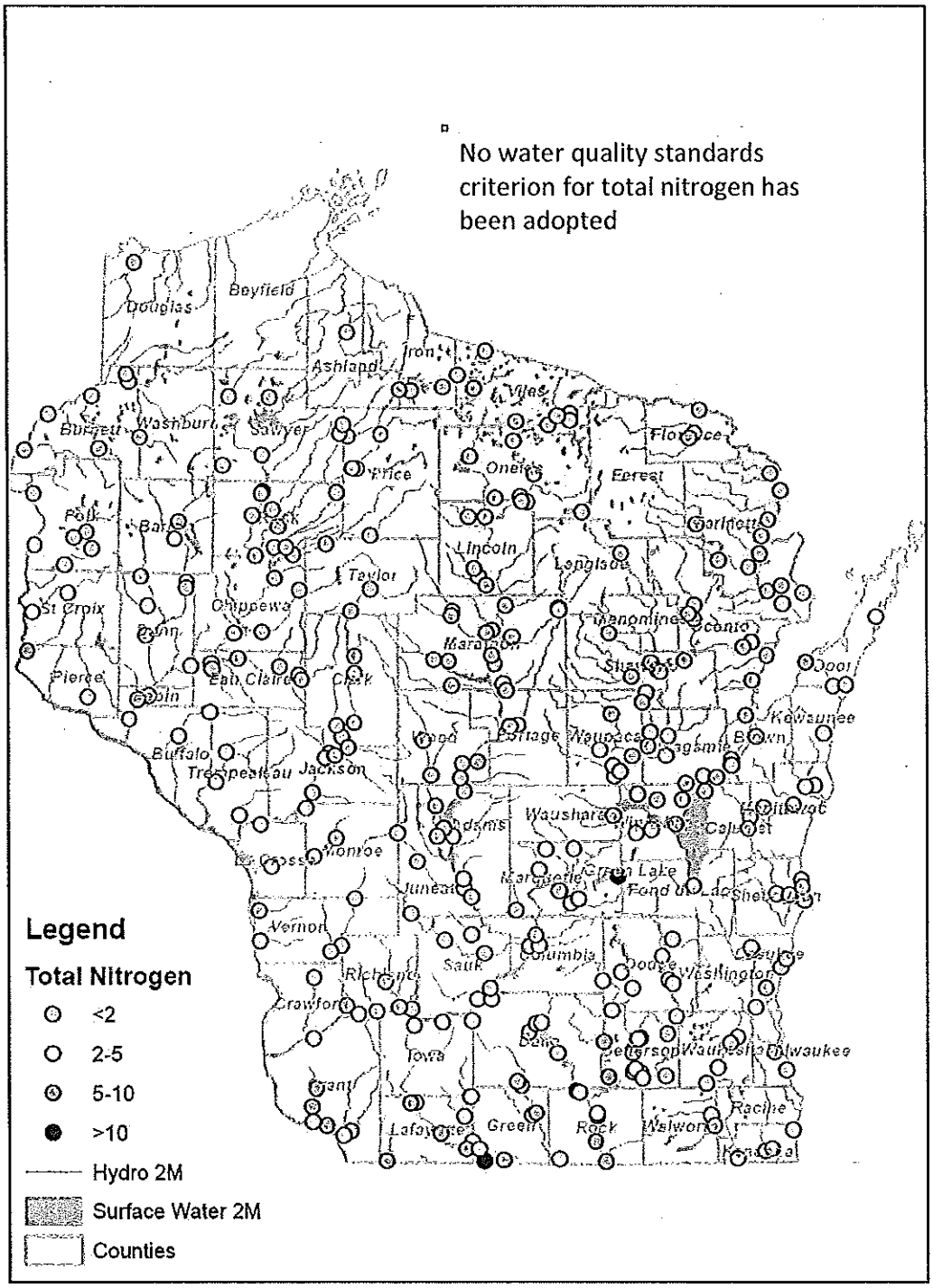

Figure 2.2 Stream Nitrogen Concentrations (Median May-October)

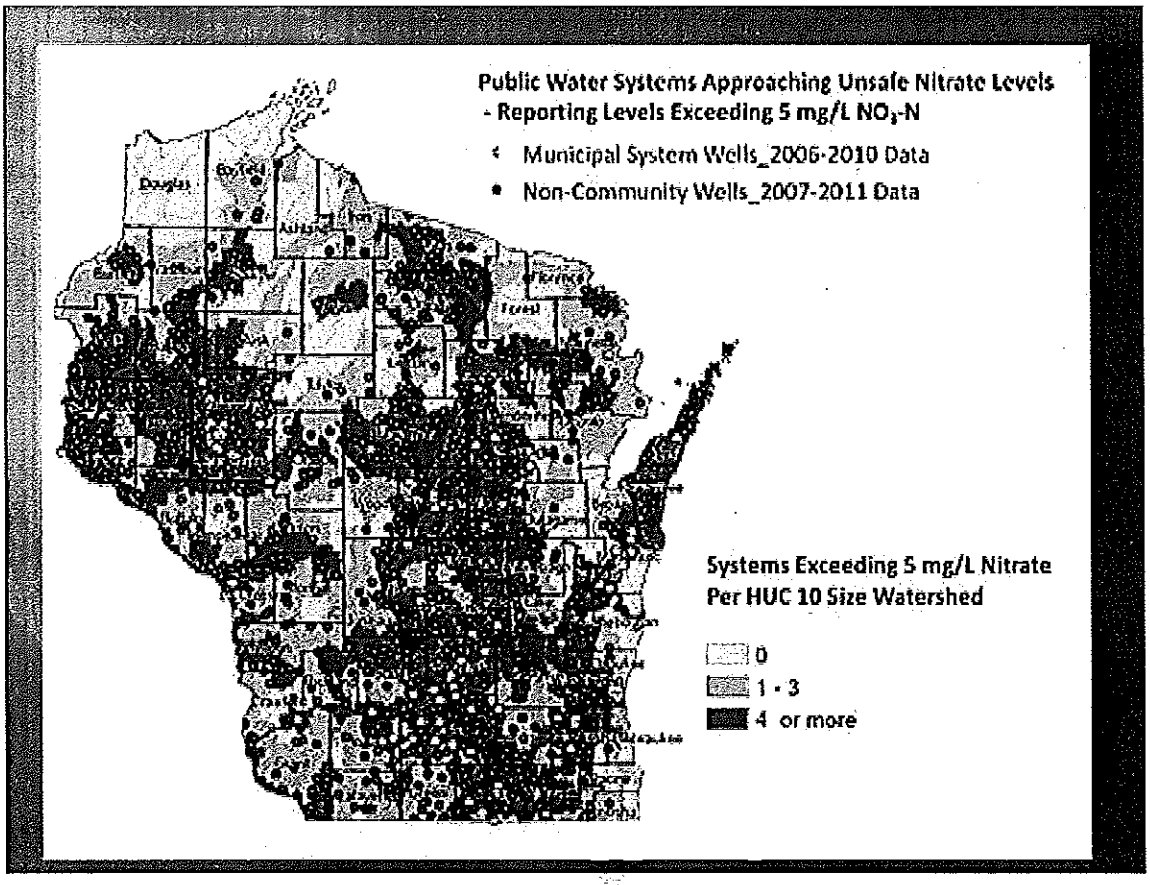

Figure 2.3 Public Water Systems with nitrate concentrations exceeding 5 mg/L.

2.2.3 Nutrient Trends

[This section will be updated when the work by Diebel and Robertson is complete.]

Data from the DNR Long-term River Trend sites and USGS flow gaging stations were used to analyze nutrient trends at over 30 locations across Wisconsin. In general, the phosphorus trends in the southeast and southwest Wisconsin show a decrease in phosphorus concentrations over the last few decades. Locations in the central and northern Wisconsin generally show no change; with the concentrations remaining relatively low. In contrast the total nitrogen concentrations tend to increase in southern Wisconsin. The numbers associated with the bars on Figures 2.4 and 2.5 indicate the period of record, such as "77" means that 1977 was used as the initial year for analysis. The analysis does not indicate the cause of the increase or decrease. Decreases in phosphorus concentrations are likely a combination in reductions from both point sources and nonpoint sources.

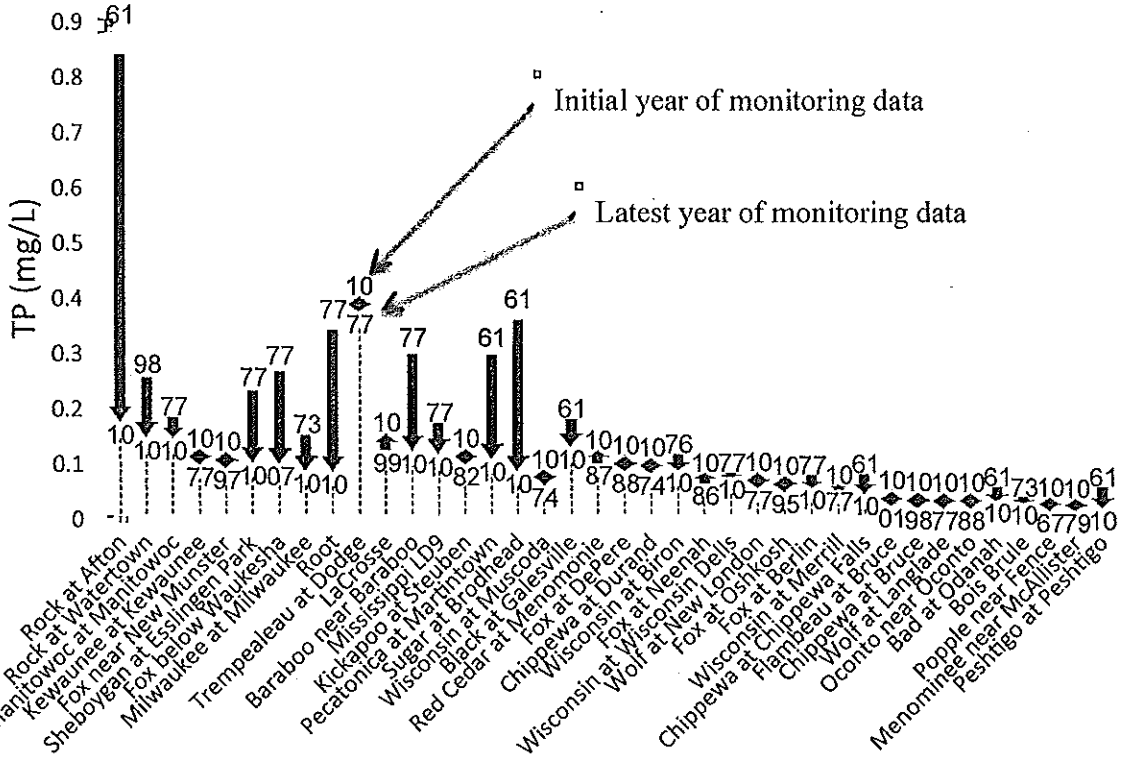

Figure 2.4 Total phosphorus concentration trends at Wisconsin River Long-Term Trend sites.

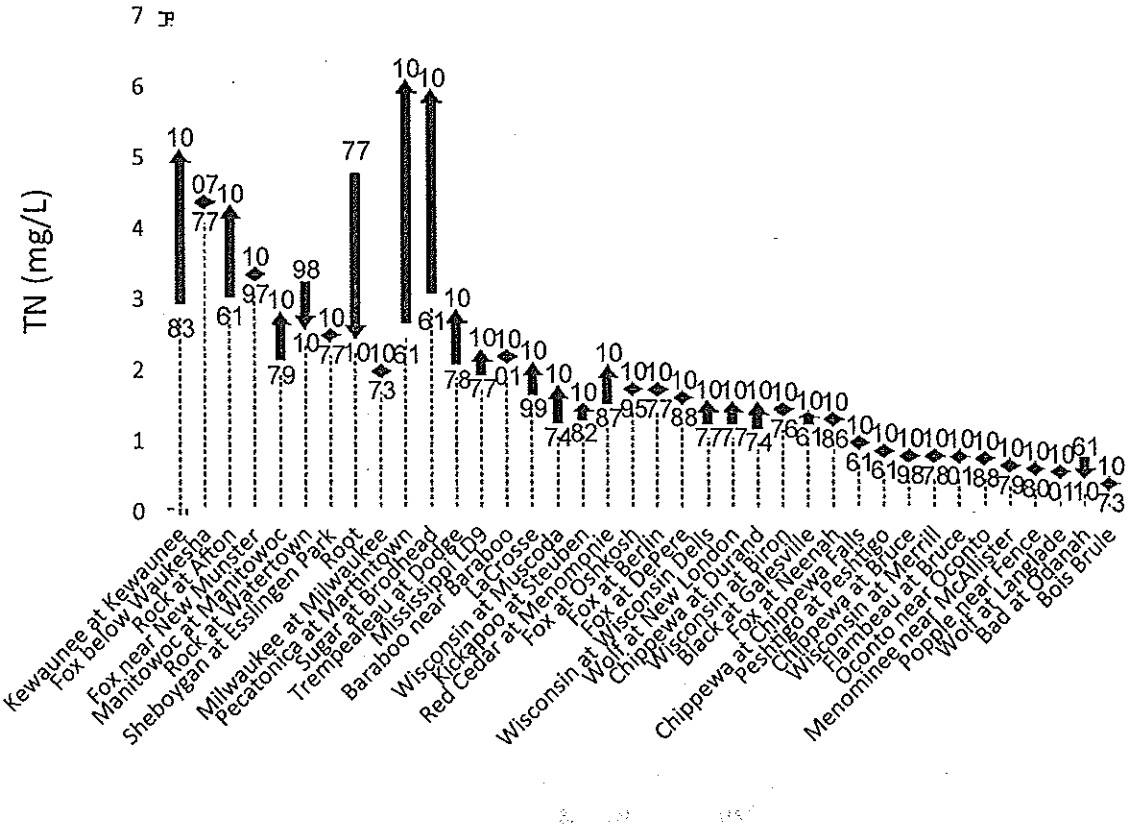

Figure 2.5 Total nitrogen concentration trends at Wisconsin Long-term River Trend sites.

2.2.4 General Approach for Nutrient Management in Wisconsin

Wisconsin programs use a variety of technology-based and water quality based approaches to manage nutrients. Technology-based approaches tend to be uniform and tied to readily available technology or practice. They do not vary by the condition of the water quality. They may, however, be adequate to result in water quality standards being met in various locations. In contrast, water quality-based approaches tailor the level of management to the specific water quality needs. For example, a total maximum daily load (TMDL) analysis for a watershed tailors both the point source and nonpoint source management to meet water quality standards. Table 2.1 shows the mix of technology-based and water quality-based approaches used by Wisconsin programs.

Table 2.1 Overview of Wisconsin Water Quality-Based Approach by Sector

Sector (described in subsequent chapters)	Technology or uniform approach	Water quality standards – based approach	Other
Agricultural nonpoint sources	State adopted performance standards and prohibitions and local ordinance requirements. Practices to implement performance standards and prohibitions designed to minimize impact on groundwater	Potentially identified as part of a TMDL implementation plan	Other conservation practices and programs, such as stream bank stabilization, riparian buffers, enrollment in Conservation Reserve Program, animal lot abandonment. Also, through source water (wellhead) protection plans
Concentrated Animal Feeding Operations -- WPDES permits	Federal and state-enacted requirements on "no discharge" from animal lot (less than 25-year, 24-hour storm) and compliance with state adopted performance standards (NR 243) Practices to implement performance standards and prohibitions designed to minimize impact on groundwater	Potentially identified as part of a TMDL implementation plan Permits may include specific requirements to meet groundwater quality standards	
Municipal Separate Storm Sewer Systems – WPDES permits	Federal minimum management measures and state-enacted performance standards. Practices to implement performance standards and prohibitions designed to minimize impact on groundwater	Potentially identified as part of a TMDL implementation plan	
Non-permitted urban areas or activities	State adopted performance standards and prohibitions. Practices to implement performance standards and prohibitions designed to minimize impact on groundwater	Potentially identified as part of a TMDL implementation plan	
Publicly and privately owned (e.g. municipal and industrial) wastewater treatment facilities – WPDES permits	Federal and state adopted technology-based requirements, including Subchapter II of NR 217 (1 mg/L or alternate limit). Also federal and state groundwater protection	Water quality based effluent limits based on federal and state requirements, including Subchapter III of NR 217 for phosphorus and NR	Note: Water quality based effluent limit compliance may be achieved through water quality trading or through implementation of a

	requirements.	106 for ammonia	watershed adaptive management option plan
On-site waste disposal systems	State adopted WPDES requirements or state sanitary code.		

2.2.5 Mississippi River Basin/Gulf Hypoxia – 45% Reduction Goal

Wisconsin should be able to reach the 45% reduction goal for phosphorus load reduction to the Mississippi River and subsequently to the Gulf of Mexico, based on an analysis conducted by the Department of Natural Resources. This presumes a 1995 base year and phosphorus reduction from point sources and nonpoint sources within the Mississippi River Basin within Wisconsin beginning in that base year and going into the future. The analysis assumes current programs and current requirements for those programs.

1995 Baseline. Consistent with the Gulf Hypoxia Action Plan, 1995 was selected as a base year. Phosphorus loads were derived for the Wisconsin portion of each of the 32 HUC 8s in Wisconsin's Mississippi River Basin using 1995 point source monitored loads and "2002 normalized" SPARROW nonpoint source load estimates.[11] For most of the Mississippi River Basin, the 1995 point source load was not the dominant source of the estimated phosphorus loads, and the substitution for the 1995 point source loads for the 2002 point source loads would not significantly influence the baseline loads.

Under the derived 1995 baseline, the combination of point source and nonpoint source loads by HUC 8 are shown in the Table 2.2 and Figure 2.6. Although Wisconsin's technology-based phosphorus effluent limits became effective statewide in late 1992, they were phased-in primarily in the late-1990s as new permits were issued with compliance dates set within the five-year permit term.

Projected Reduction. The projected reduction is estimated for both point sources and nonpoint sources using existing data and a series of assumptions. This projection does not specify a time period.

For municipal and industrial wastewater treatment facilities, the projected reduction is based on comparing the actual or estimated 1995 baseline phosphorus loads to the actual 2009 point source contribution on a facility-by-facility basis using discharge monitoring report information. Discharges for 2009 are very similar to those for 2010 and 2011, and reflect current conditions and compliance with state WPDES permit program technology-based phosphorus control requirements described in Subchapter II of NR 217, Wis. Adm. Code. For the basin as a whole, the wastewater point source phosphorus discharge has been reduced by **67percent** since the 1995 baseline. Compliance with the more recent water quality-based requirements in Subchapter III of NR 217 may produce additional

[11] For wastewater point sources 1995 discharge monitoring report data were used, if available. If not, data from the closest year were used. The 2002 SPARROW model results were deemed appropriate for a 1995 nonpoint source baseline since the calibration data used by USGS were collected near to 2002, including data that may have been collected five, ten or more years prior to 2002. For each HUC 8, the 2002 point source loads were subtracted from the total "2002-normalized: SPARROW load to derive a nonpoint source estimate.

load reductions. However, compliance with these newer requirements may come in the form of water quality trading or implementation of watershed plans under the Wisconsin watershed adaptive management option. As such, there could be some overlap with the nonpoint source load reduction. Thus, the 2009 conditions are used in conservatively estimating future phosphorus loads from these facilities.

For storm water management in urban areas, the analysis assumes a 10% phosphorus load reduction. Current WPDES permits call for a 20% or 40% reduction in suspended solids loads. It is assumed that the phosphorus load reduction will be one-third to one-half of the reduction for suspended solids load reduction. Thus, the 10% load reduction is conservatively assumed for urban areas. Some TMDLs may call for further reduction.

For agricultural lands, two assumptions are made:

- A 10% load reduction from 1995 to present. With substantial implementation of federal, state and local conservation programs, a higher reduction could be assumed. However, available data, such as from the NRCS Natural Resource Inventory, shows a degree of backsliding in Wisconsin and other states during this period. Taking land out of the Conservation Reserve Program is commonly cited as one of the reasons for falling back. On the other hand there is much anecdotal information from across the state that many smaller animal lots immediately adjacent to streams have been removed, and new slope diversions have been installed on many other animal lots. Thus, the 10% reduction represents a conservative reduction from 1995 to present.
- A 30% reduction into the future. Experience in the Pleasant Valley watershed project in southwestern Wisconsin shows that a 25 to 30% reduction is reasonable to achieve through meeting the phosphorus index performance standard. Compliance with other performance standards will increase the percent reduction. Thus, a 30% future reduction is deemed a reasonable further reduction.[12] This reduction may be achieved through the programs listed in Chapter 3 of this strategy, including NRCS's Environmental Incentives Program, DNR's Runoff Management Program (including Targeted Runoff Management Grants and Notice of Discharge grants); WDATCP's Farmland Preservation/Working Lands Initiative and county programs.

For all other lands, such as wetlands, barren lands and wooded lands, no reduction is assumed.

Using the above assumptions, about a 40% reduction is estimated. It is further expected that reductions in phosphorus load needed to implement TMDLs will bridge the remaining gap to achieve the 45% reduction goal. Table 2.3 and Figure 2.7 show the projected reduction for each Mississippi River Basin HUC 8 watershed using the assumptions described above.

[12] Personal communication Laura Ward Good, University of Wisconsin – Madison.

Table 2.2. 1995 Baseline Phosphorus Loads by HUC 8 Watershed (listed in order of decreasing nonpoint source yields)

8-Digit HUC Name	Nonpoint Source Load (lb/yr) (1)	1995 Point Source Load (lb/yr) (2)	1995 Total Load (lb/yr)	% Nonpoint Source	% Point Source
Grant-Little Maquoketa	499,755	27,404	527,159	95%	5%
Pecatonica River	642,667	19,391	662,058	97%	3%
Apple-Plum Rivers	82,735	7,293	90,028	92%	8%
Coon-Yellow Rivers	254,458	15,657	270,115	94%	6%
Des Plaines River	44,392	8,283	52,675	84%	16%
Sugar River	216,708	27,743	244,451	89%	11%
Kickapoo River	229,545	19,359	248,904	92%	8%
Lower Rock River	236,423	379,639	616,062	38%	62%
Upper Rock River	401,250	330,414	731,664	55%	45%
Baraboo River	186,795	28,045	214,840	87%	13%
Buffalo-Whitewater Rivers	206,814	7,482	214,296	97%	3%
Rush-Vermillion Rivers	121,479	13,780	135,259	90%	10%
Lower Wisconsin River	538,274	21,454	559,728	96%	4%
Trempealeau River	527,810	45,467	573,277	92%	8%
Black River	477,914	55,769	533,683	90%	10%
La Crosse-Pine Rivers	119,466	255,094	374,560	32%	68%
Lake Dubay	519,094	124,151	643,245	81%	19%
Eau Claire River	138,624	2,706	141,330	98%	2%
Lower Chippewa River	317,434	59,941	377,375	84%	16%
Upper Fox River	136,103	61,372	197,475	69%	31%
Red Cedar River	268,346	35,295	303,641	88%	12%
Castle-Rock	353,684	514,524	868,208	41%	59%
Lower St. Croix River	209,114	27,256	236,370	88%	12%
Jump River	105,681	2,245	107,926	98%	2%
Upper Chippewa River	161,258	549	161,807	100%	0%
Upper St. Croix River	99,276	1,238	100,514	99%	1%
Namekagon River	49,827	-	49,827	100%	0%
Flambeau River	61,762	46,602	108,364	57%	43%
South Fork Flambeau River	39,125	5,243	44,368	88%	12%
Upper Wisconsin River	85,220	81,442	166,662	51%	49%
Totals	7,331,035	2,224,838	9,555,873	77%	23%

Table Notes:

(1)Nonpoint sources include agricultural lands, urban lands, wetlands, woodlands, etc.

(2) Point source loads do not include urban storm water runoff, CAFOs, and biosolids application to land. These runoff related point sources are included in the nonpoint source column.

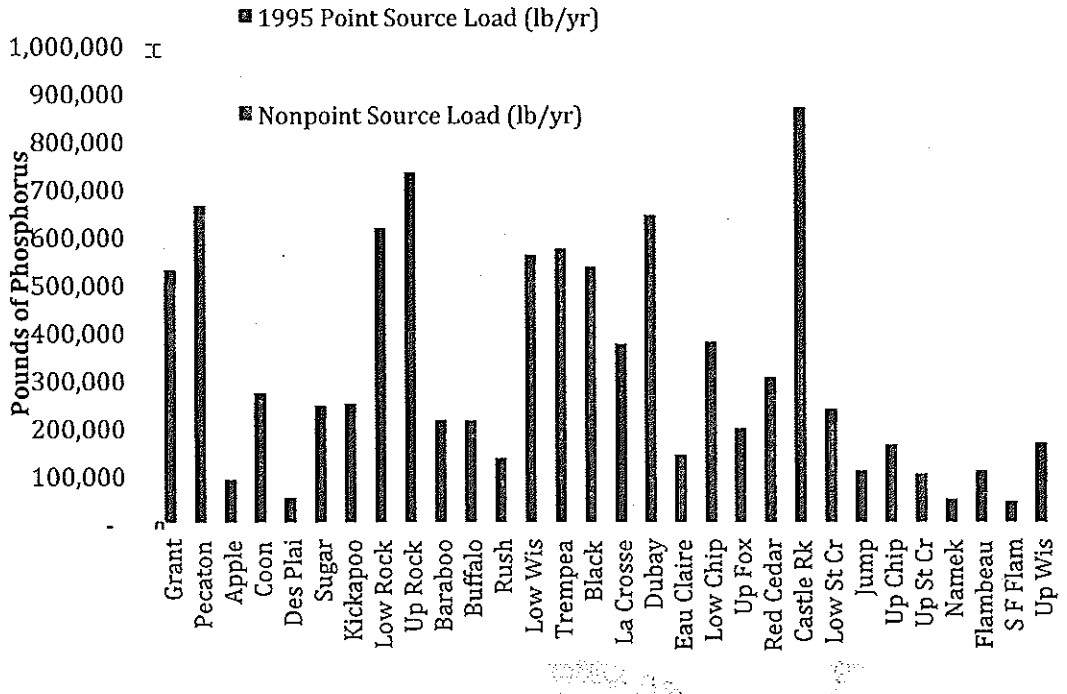

Figure 2.6 Estimated 1995 Baseline Phosphorus Load for Mississippi River Basin by HUC 8 Watershed

Table 2.3 Projected Phosphorus Reduction for Mississippi River Basin using Existing Point Source and Nonpoint Source Programs – By HUC 8 Watershed

HUC 8 Name	Nonpoint Source Load (lb/yr)	1995 Point Source Load (lb/yr)	1995 Total Load	Projected Nonpoint Source Load	Projected Point Source Load	Projected Total Load	% Red. by HUC 8
Grant- Maquoketa R	499,755	27,404	527,159	315,601	10,593	326,194	38%
Pecatonica River	642,667	19,391	662,058	401,970	14,130	416,100	37%
Apple-Plum Rivers	82,735	7,293	90,028	51,426	6,928	58,354	35%
Coon-Yellow Rivers	254,458	15,657	270,115	169,543	12,336	181,879	33%
Des Plaines River	44,392	8,283	52,675	30,274	1,195	31,469	40%
Sugar River	216,708	27,743	244,451	137,511	11,574	149,085	39%
Kickapoo River	229,545	19,359	248,904	151,100	4,614	155,714	37%
Lower Rock River	236,423	379,639	616,062	157,748	145,897	303,645	51%
Upper Rock River	401,250	330,414	731,664	260,691	63,461	324,152	56%
Baraboo River	186,795	28,045	214,840	121,254	14,234	135,488	37%
Buffalo-Whitewater	206,814	7,482	214,296	137,540	2,338	139,878	35%
Rush-Vermillion Rivers	121,479	13,780	135,259	78,122	7,819	85,941	36%
Lower Wisconsin River	538,274	21,454	559,728	355,509	20,679	376,188	33%
Trempealeau River	527,810	45,467	573,277	345,743	6,074	351,817	39%
Black River	477,914	55,769	533,683	345,370	11,803	357,173	33%
La Crosse-Pine Rivers	119,466	255,094	374,560	84,331	31,059	115,390	69%
Lake Dubay	519,094	124,151	643,245	372,779	46,747	419,526	35%
Eau Claire River	138,624	2,706	141,330	97,542	1,873	99,415	30%
Lower Chippewa River	317,434	59,941	377,375	219,067	27,445	246,512	35%
Upper Fox River	136,103	61,372	197,475	96,493	56,714	153,207	22%
Red Cedar River	268,346	35,295	303,641	185,054	14,731	199,785	34%
Castle-Rock	353,684	514,524	868,208	254,443	118,066	372,509	57%
Lower St. Croix River	209,114	27,256	236,370	143,881	15,759	159,640	32%
Jump River	105,681	2,245	107,926	86,386	1,306	87,692	19%
Upper Chippewa River	161,258	549	161,807	142,102	259	142,361	12%
Upper St. Croix River	99,276	1,238	100,514	84,715	429	85,144	15%
Namekagon River	49,827	-	49,827	45,421	-	45,421	9%
Flambeau River	61,762	46,602	108,364	57,522	20,980	78,502	28%
S. Fork Flambeau River	39,125	5,243	44,368	35,745	906	36,651	17%
Upper Wisconsin River	85,220	81,442	166,662	79,670	56,242	135,912	18%
Total Mississippi River Basin	7,331,035	2,224,838	9,555,873	5,044,554	726,191	5,770,745	
% Reduction				31%	67%	40%	

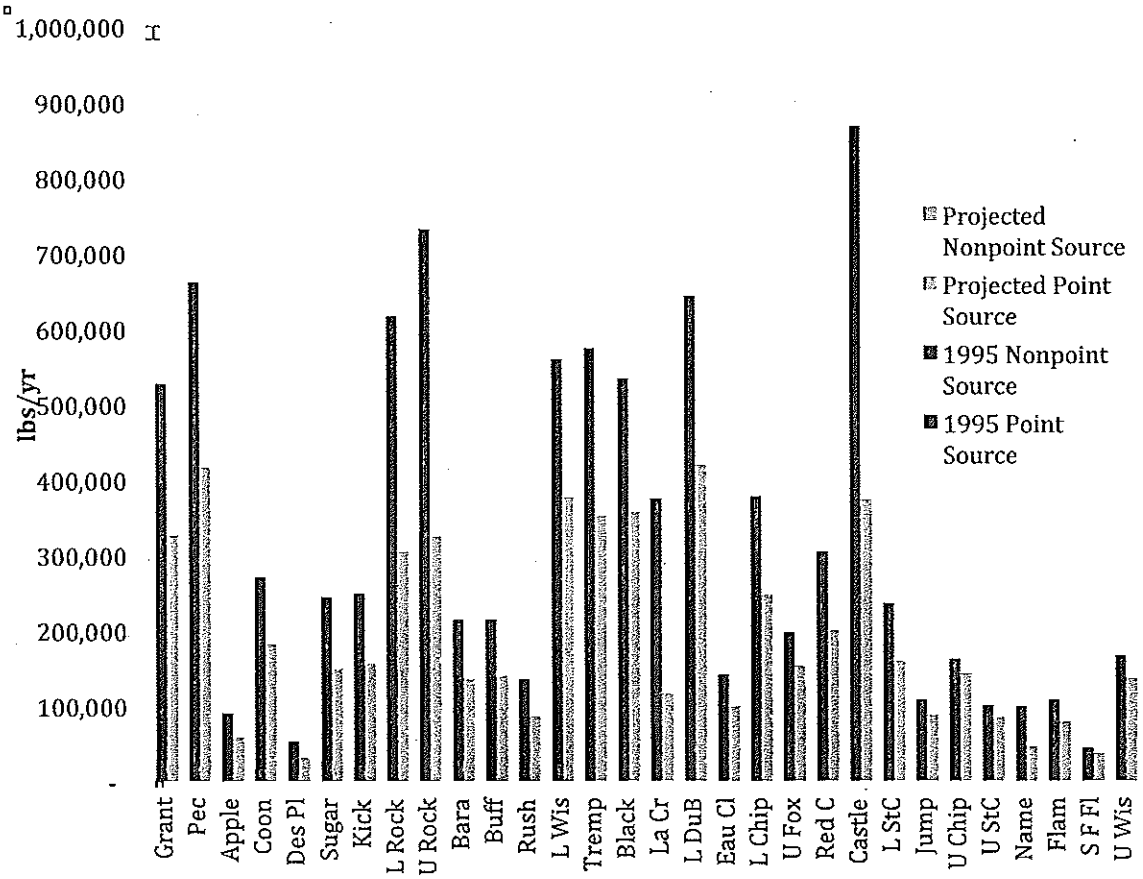

Figure 2.7 Estimated 1995 Baseline and Projected Future Phosphorus Loads for Mississippi River Basin by HUC 8 Watershed

Progress to date – Gulf Hypoxia Goals

The Gulf Hypoxia goals call for a 45% reduction in the phosphorus and nitrogen load (amount or mass) reaching the Gulf from each state using the early to mid-1990s as a base period. As shown in Figure 2.3 and described in greater detail in Chapter 2 of this strategy, the total average annual amount of phosphorus reaching surface waters in the Mississippi River Basin in 1995, the base year selected for this strategy, was estimated to be about 9,600,000 pounds. During 1995, municipal and industrial wastewater treatment facilities discharged about 2,200,000 pounds, about 23% of the total amount. The remainder is in a broad "nonpoint source" category that includes urban storm water runoff (many locations now under point source permits), agricultural sources (including Concentrated Animal Feeding Operations), forested areas, wetlands, etc.

Today the phosphorus loads have been reduced. There has been substantial implementation of the technology-based phosphorus removal requirements adopted in 1992 for municipal and industrial wastewater point sources. The average annual phosphorus discharge from these point sources in the Mississippi River Basin has decreased by 67% to about 700,000 pounds; representing an overall reduction of nearly 16%. From 1995 to present, phosphorus has also been reduced from nonpoint

sources; however, the specific amount cannot currently be accurately determined. Clearly much implementation has taken place. For example, the Wisconsin Nonpoint Source Pollution Abatement Program Priority Watershed Projects alone expended over $200 million in state funds with much of the expenditures occurring after 1995.[13] The federal Environmental Quality Incentives Program (EQIP), administered by the Natural Resources Conservation Service (NRCS), made comparable expenditures. A conservative estimate is that the nonpoint source phosphorus loads have been reduced by 10% or about 730,000 pounds since 1995. It can be argued that a higher estimate is appropriate.

Together, the documented wastewater point source reduction and the conservatively estimated nonpoint source reduction have decreased the Mississippi River phosphorus load by about 23%, halfway to the 45% reduction goal. (See Figure 2.8.)

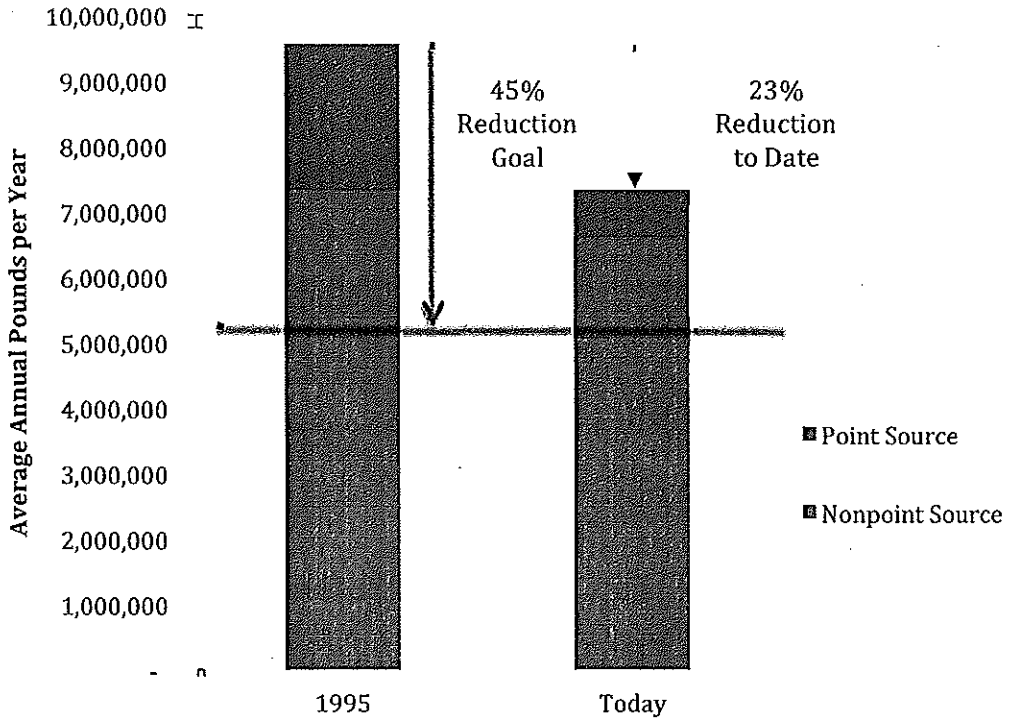

Figure 2.8. Gulf Hypoxia Phosphorus Load Reduction Goal and Estimated Progress to Date

[13] "Nonpoint Source Water Pollution Abatement and Soil Conservation Programs", Informational Paper 69, Wisconsin Legislative Fiscal Bureau, January 2013.

2.2.6 Lake Michigan – Estimated Phosphorus Load Reduction

A phosphorus load reduction is estimated for Lake Michigan, including Green Bay, using the same assumptions, data inputs and analysis described for the Mississippi River Basin above and shown in Table 2.4 and Figure 2.9 below. The following items help illustrate differences between the two major basins:

- The majority of the municipal wastewater treatment plant discharge reduction came in the 1980s, prior to the base year, as a result of international agreements for phosphorus reductions for the Great Lakes. As a result, the point source phosphorus loads have remained unchanged or even increased in some of the HUC 8s since 1995.
- Some reductions in municipal wastewater facility phosphorus discharges have occurred, with the largest being at the Milwaukee Metropolitan Sewerage District plants.
- There has been a decrease in phosphorus discharges since 1995 from industrial wastewater facilities.
- For this analysis, urban storm water discharges are included in the nonpoint source category (as they are in SPARROW). Given the large urban areas within a number of the HUC 8s of the Lake Michigan Basin, this is a large component of the nonpoint source load for those HUC 8s.

Table 2.4 Projected Phosphorus Reduction for Lake Michigan using Existing Point Source and Nonpoint Source Programs – By HUC 8

HUC 8 Name	Nonpoint Source Load (lb/yr)	1995 Point Source Load (lb/yr)	1995 Total Load	Projected Nonpoint Source Load	Projected Point Source Load	Projected Total Load	% Reduct. by HUC 8
Lower Fox River	270,672	344,201	614,873	193,293	157,807	351,100	43%
Pensaukee River	133,995	524	134,519	90,204	748	90,952	32%
Manitowoc-Sheboygan	458,625	87,646	546,271	300,839	69,289	370,128	32%
Lake Winnebago	114,353	19,628	133,981	77,207	18,942	96,149	28%
Door-Kewaunee Rivers	221,589	6,530	228,119	147,842	4,927	152,769	33%
Pike-Root Rivers	94,562	925,951	1,020,513	72,623	364,311	436,934	57%
Milwaukee River	212,662	80,206	292,868	157,419	41,982	199,401	32%
Upper Fox River	229,076	30,374	259,450	155,161	25,945	181,106	30%
Wolf River	489,918	49,403	539,321	350,479	25,945	376,424	30%
Oconto River	125,579	6,720	132,299	97,447	7,847	105,294	20%
Brule River	14,577	-	14,577	13,626		13,626	7%
Peshtigo River	85,594	10,733	96,327	69,133	4,278	73,411	24%
Menominee River	94,861	38,367	133,228	86,870	6,323	93,193	30%
Total Lake Michigan Basin	2,546,061	1,600,283	4,146,344	1,812,143	728,344	2,540,487	
% Reduction				29%	54%	39%	

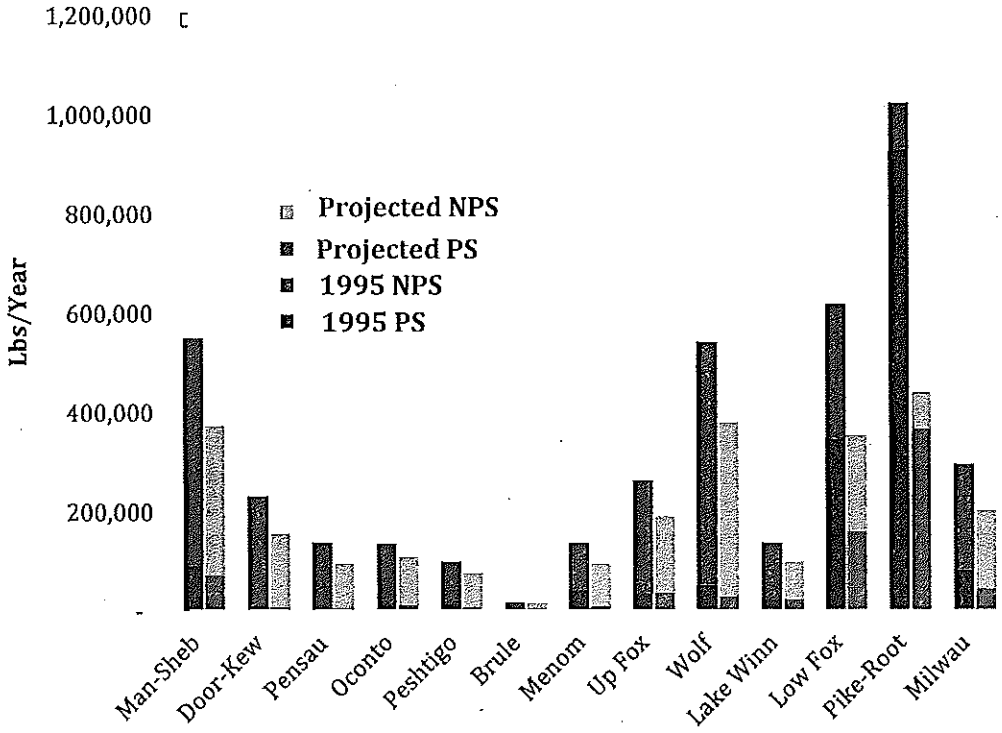

Figure 2.9 Estimated 1995 Baseline and Projected Future Phosphorus Load for Lake Michigan Basin by HUC 8 Watershed[14]

Progress to Date – Lake Michigan Basin

As shown in Figure 2.10, there has been an estimated 27% reduction since 1995 using the same analysis as used for the Mississippi River Basin. The municipal and industrial wastewater point sources' phosphorus loads have been reduced by 54%. However, there has been substantial reduction in phosphorus discharges in the 1980s, prior to the 1995 base year. No phosphorus or nitrogen load reduction goals have been identified for Lake Michigan.

[14] Man-Sheb = Manitowoc and Sheboygan; Pensau = Pensaukee; Menom = Menominee; Up Fox = Upper Fox; Lake Winn = Lake Winnebago; Low Fox = Lowr Fox and Milwau = Milwaukee

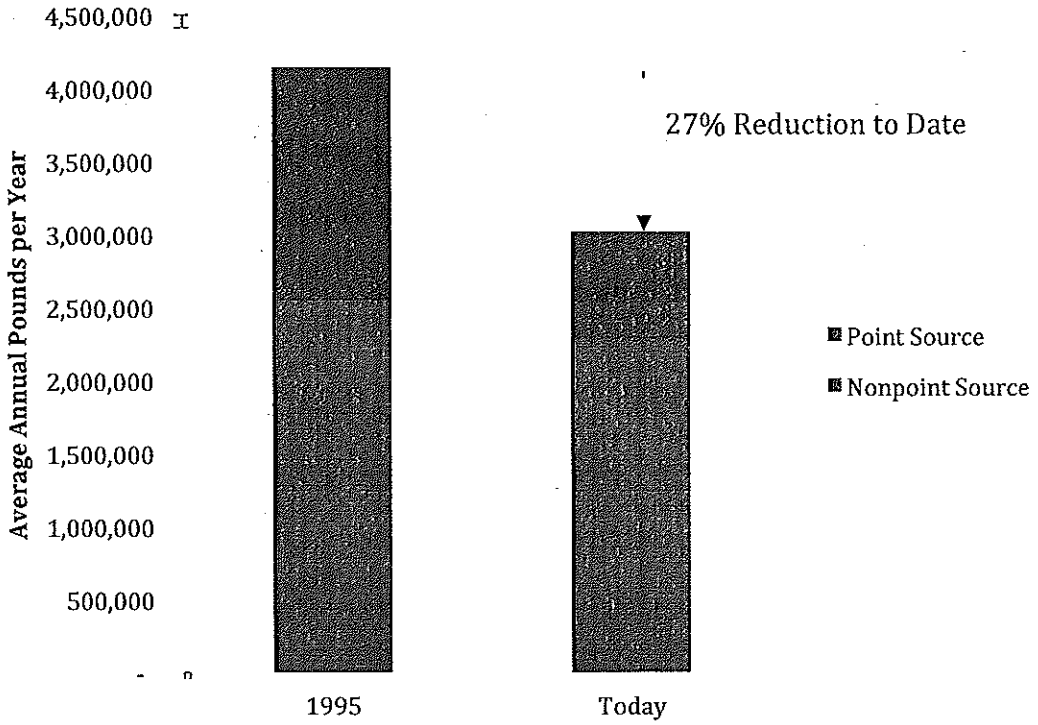

Figure 2.10 Lake Michigan Basin Phosphorus Load Reduction Estimated Progress to Date

2.2.7 Total Maximum Daily Load Analyses

Implementation of TMDLs will provide additional phosphorus load reductions beyond what would be achieved through compliance with the Chapter NR 151, Wis. Adm. Code, performance standards and prohibitions (see Chapter 4 for more information). TMDLs are the primary means for setting watershed specific load reductions for Wisconsin lakes and streams identified as impaired (not meeting water quality standards). In each TMDL analysis involving nutrients, such as phosphorus, specific load reductions are identified for both point sources and nonpoint sources (wasteload allocations and load allocations) that are necessary to attain water quality standards.

For many TMDL analyses, a level of nutrient reduction for nonpoint sources will exceed the reduction provided by the Chapter NR 151 performance standards and prohibitions. That is, compliance with the performance standards and prohibitions may not be adequate to achieve phosphorus water quality standards criteria. Implementation plans for approved TMDLs will specify what additional control is needed.

Chapter 3 - Point Source Permits

Element 3. Ensure Effectiveness of Point Source Permits in Targeted/Priority Sub-watersheds for Wastewater facilities, CAFOs, and Urban Storm Water

3.1 EPA and Gulf Hypoxia Task Force Expectations

EPA's expectation emphasizes ensuring that point source control permits in targeted or priority watersheds are effective with respect to:

"A. Municipal and Industrial Wastewater Treatment facilities that contribute to significant and measureable N & P loadings,

"B. All Concentrated Animal Feeding Operations (CAFOs) that discharge or propose to discharge, and/or

"C. Urban Storm water sources that discharge into N & P- impaired waters or are otherwise identified as a significant source [of nitrogen and phosphorus]."

3.2 Wisconsin's Approach

Wisconsin conducts a statewide water quality permit program to control phosphorus contributions from municipal and industrial wastewater treatment facilities, concentrated animal feeding operations (CAFO), and urban storm water sources. The Wisconsin Pollutant Discharge Elimination System (WPDES) permit program is established by Chapter 283, Wisconsin Statutes, and delegated authority to administer the federal Clean Water Act permit program. WPDES permits are issued by the DNR Bureaus of Water Quality and Watershed Management, with federal oversight from EPA. Wisconsin's Office of the Attorney General provides legal resources for enforcement. Permits for groundwater discharges are issued under state law. DNR is responsible for the issuance, reissuance, modification, and enforcement of all WPDES permits issued for discharges into the waters of Wisconsin, except discharges occurring on Native American lands which are regulated directly by EPA.

Wisconsin regulates discharges to both groundwater and surface water. Facilities discharging wastewater from a specific point (end of a pipe) must meet either the federal minimum requirements for secondary treatment for municipalities and technology-based categorical (or base level) limits for industries; or, the discharges must meet levels necessary to achieve water quality standards, whichever is more stringent. Land disposal systems also receive permits with limits established to protect groundwater.

WPDES permits contain all the monitoring requirements, special reports, and compliance schedules appropriate to the facility in question. Permits are issued for five-year periods as either individual or general permits. Individual WPDES permits are issued to municipal and industrial facilities discharging to surface water and/or groundwater. Approximately 350 industrial facilities and approximately 650 municipalities hold individual WPDES permits.

General WPDES permits are issued for specific categories of industrial, municipal and other wastewater discharges. DNR may issue WPDES general permits applicable to categories or classes of point source discharges. When a general permit is issued, many facilities meeting its requirements may be covered under the same general permit. Several WPDES general permit categories have the potential to influence nutrient loads, including: land application of by-product solids, industrial sludge, and industrial waste; pit/trench dewatering; Sanitary Sewer Overflows (SSO) from Sewage Collection Systems, and more (see http://dnr.wi.gov/topic/wastewater/Permits.html).

WPDES permit information is available at: http://dnr.wi.gov/topic/wastewater/PermitLists.html. Locations of permit discharges may be found on the DNR surface water data viewer at: http://dnr.wi.gov/topic/surfacewater/swdv/

3.2.1 Permits for Municipal and industrial wastewater treatment facilities

Phosphorus

Wisconsin, through the provisions of Chapter NR 217, Wis. Adm. Code (hereafter in this chapter referred to as ch. NR 217) has technology-based phosphorus limits that have been in effect since the early 1980s for the Great Lakes basin and statewide since 1993. Wisconsin enacted additional administrative rules for phosphorus water quality standards criteria and resulting water quality based effluent limits in 2010.

Subchapter 2 of NR 217, Wis. Adm. Code, regulates technology based limits enacted in 1992. Wisconsin's publically owned treatment works and privately owned domestic sewage works that discharge more than 150 pounds of total phosphorus per month have been limited to a 1 mg/L effluent concentration or an alternative limit as a monthly average for more than two decades. An effluent limitation equal to 1 mg/L total phosphorus or an alternative limit as a monthly average also applies in certain cases. These cases are where the discharge of wastewater from all outfalls of a facility other than those subject to ch. NR 210, Wis. Adm. Code (generally non-municipal), contains a cumulative total of more than 60 pounds of total phosphorus per month. The 1 mg/L discharge limit is a Technology Based Effluent Limit (TBEL). The intent of technology-based effluent limits is to require a minimum level of treatment of pollutants for point source discharges based on available treatment technologies, while allowing the discharger to use any available control technique to meet the limits. Since 1993 there has been about a 67% reduction in phosphorus discharged from wastewater facilities in the Mississippi River basin as a result of complying with the technology based requirements and a 54% reduction in the Great Lakes Basin.

Some WPDES permits now include a water quality based effluent limit (WQBEL), based on the quality of the receiving water, rather than available treatment technologies. These provisions became effective in 2010 and have been approved by EPA as part of the delegation agreement. In order to ensure the protection of water quality and the designated uses of the receiving water, WQBELs may be more stringent than technology-based effluent limits. As specified in ch. NR 217, Wis. Adm. Code, a WQBEL may be used in WPDES permits if the following conditions are met:

- When the discharge from a point source contains phosphorus at concentrations or loadings that will cause, has the reasonable potential to cause, or contribute to an exceedance of the

criteria in s. NR 102.06, Wis. Adm. Code, in either the receiving water or downstream waters; and
- The technology based effluent limitation is less stringent than necessary to achieve the applicable water quality standard for phosphorus in s. NR 102.06, Wis. Adm. Code.

Since the WQBELs enacted in the 2010 revisions to ch. NR 217, Wis. Adm. Code, are potentially much more stringent than TBEL that have been in effect since 1993, there is some flexibility in how the WQBEL is achieved. WPDES permittees may be eligible for two approaches that blend point source and nonpoint source phosphorus control for overall water quality benefits. These approaches (water quality trading and the watershed adaptive management option, discussed in greater detail in chapter 5 of this strategy) allow WPDES permittees to meet their obligations by working with other WPDES permittees or nonpoint sources to reduce phosphorus in waterways.

Nitrogen

Historically, since phosphorus is the key nutrient of concern causing eutrophication in freshwater systems in the Midwest, the requirements for monitoring and controlling nitrogen in surface water discharges has been limited mainly to ammonia due to its toxicity to fish and aquatic life. Monitoring and discharge limits for ammonia have been included in WPDES permits since the 1980s. Generally total nitrogen discharge limits have not been included in WPDES permits.

Since 2008, DNR has required a single analysis of nitrate/nitrite and total Kjeldahl nitrogen for all facilities with their permit applications. Recently, Wisconsin implemented additional monitoring and reporting actions for WPDES permittees in the Mississippi River Basin consistent with the Gulf Hypoxia Task Force Action Plan. The following actions are currently taking place or being phased in as permits are renewed:

- Include total nitrogen (ammonia nitrogen, organic nitrogen, and nitrate/nitrite) quarterly monitoring for major municipalities (greater than 1 MGD) discharging to the Mississippi River Basin.
- Require quarterly total nitrogen permit monitoring for facilities whose permit application shows levels of total nitrogen greater than 40 mg/L.
- Include total nitrogen monitoring in reissued permits for larger cheese plants.
- Monitor meat processors for total nitrogen.
- Continue to require a single analysis of total nitrogen for all facilities with the permit application.
- Since data from paper mills indicate low levels of total nitrogen discharged, no additional permit related monitoring of these discharges is warranted.
- Evaluate future data to determine whether a seasonal variability exists.
- Ensure that the DNR wastewater database tracks which facilities have biological phosphorus removal to enable a future evaluation on the relationship between biological phosphorus and total nitrogen removal.

Wisconsin regulates total nitrogen in groundwater discharges consistent with the 1984 enactment of Wisconsin's groundwater law, Chapter 160, Wisconsin Statutes. For wastewater facilities that discharge treated effluent to groundwater, it is assumed that all forms of nitrogen discharged eventually convert naturally to nitrate, for which there is a health-based drinking water standard of

10 mg/L. DNR limits total nitrogen to 10 mg/L and requires data collection for facilities that discharge to groundwater.

3.2.2 CAFO permits

Phosphorus contributions and to some degree nitrogen contributions from Concentrated Animal Feeding Operations (CAFOs) are controlled by WPDES permits. A Wisconsin livestock operation with 1,000 animal units or more is a Large CAFO. Large CAFOs must have a WPDES permit to operate. These water quality protection permits ensure farms use proper planning, nutrient management, structures, and systems to protect Wisconsin waters. Wisconsin's CAFO permit requirements are in Chapter NR 243, Wis. Adm. Code. DNR may designate a smaller-scale animal feeding operation (fewer than 1,000 animal units) as a CAFO if it has pollutant discharges to navigable waters or contaminates a well.

Under ch. NR 243, Wis. Adm. Code, WPDES permitted CAFOs have the following requirements (not exhaustive):

- Operators must complete the Animal Units Calculation Worksheet so they can determine if they are a CAFO and need to apply for the WPDES permit.
- Operators must complete the WPDES preliminary and final permit applications. If an operation plans to become a CAFO it must submit a preliminary permit application 12 months prior to reaching CAFO size and a final detailed application six months prior to reaching CAFO size.
- WPDES permitted CAFOs must construct manure and process wastewater storage and handling systems in accordance with accepted design standards. There is a zero discharge standard for feedlot and feed storage runoff.
- CAFOs must properly dispose of animal carcasses and develop an emergency response plan for addressing catastrophic spills.
- Farms must develop and implement a nutrient management plan for when, where and how much manure and process wastewater they will apply on cropped fields.
- Manure spread on land must be set back from drinking water wells, sinkholes and fractured bedrock. Additional restrictions apply to manure and process wastewater spread on shallow soils over fractured bedrock.
- Operators may not spread liquid manure on frozen or snow–covered ground unless it's injected or immediately incorporated into soil or there is an emergency outside the operation's control.
- Operators may not spread solid manure on frozen or snow-covered ground during February and March unless immediately incorporated. Farmers can stack solid manure in fields or store it in a designed structure during February and March.
- Six months of liquid manure storage is required with some exceptions.
- There are also inspection, monitoring and reporting requirements, which are included in the Wisconsin CAFO Compliance Calendar.

In addition to the WPDES permit requirements of ch. NR 243, Wis. Adm. Code, CAFOs must also meet Wisconsin's agricultural performance standards and prohibitions, as detailed in ch. NR 151, Wis. Adm. Code. These standards and prohibitions must be met by all agricultural operations, not

just permitted operations. More discussion of these performance standards and prohibitions can be found in Chapter 4 of this strategy.

3.2.3 Municipal Storm Water Discharge Permits

Approximately 220 municipalities in Wisconsin are currently required to have a Municipal Separate Storm Sewer System (MS4) permit. A MS4 permit is required for a municipality that meets one of the following criteria:

- It is located within a federally-designated Urbanized Area,
- Its population equals 10,000 or more based on the latest decennial census; or
- DNR designates the municipality for permit coverage in accordance with s. NR 216.025, Wis. Adm. Code. The MS4 permits are effective for a period of up to five years, at which point the permits are updated and re-issued.

The MS4 permits require municipalities to reduce polluted storm water runoff by implementing storm water management programs with best management practices. The MS4 permits do not contain numerical effluent limits like other WPDES permits. Municipal storm water management programs cover a wide array of activities that occur within a municipality. The permits contain the following required elements:

- Public Education and Outreach: The MS4 permit specifies that public education and outreach programs be developed to encourage the public and businesses to modify their behaviors and procedures to reduce storm water pollution.
- Public Involvement and Participation: In addition to public education and outreach, the MS4 permit requires municipalities to encourage participation from individuals to prevent storm water pollution. Some examples of public involvement are volunteer stream monitoring, storm drain stenciling, presenting information to established community groups, or planting a community rain garden.
- Illicit Discharge Detection and Elimination: Storm sewers that carry rain water runoff are not intended for other fluids and waste material. These pollutants are illicit discharges and may have the potential to harm people, animals and aquatic life in the downstream rivers, lakes and wetlands. Municipalities are required to develop programs to identify, prevent, and eliminate illicit discharges to their storm sewer systems. The DNR has developed additional illicit discharge detection and elimination guidance to assist municipalities with this requirement.
- Construction Site Pollutant Control: Municipalities are required to develop a soil erosion control ordinance and enforce it on construction sites. Municipalities may use state-recommended technical standards for methods and products used to control erosion and prevent sediment-laden water from discharging into a lake, stream or wetland.
- Post-Construction Storm water Management: Municipalities are required to develop a post-construction ordinance and enforce it to ensure that areas of new and redevelopment will include structural measures to control pollutants, control peak flow, maintain infiltration, and establish vegetated protective areas adjacent to waterways and wetlands. Municipalities may use state-recommended technical standards for post-construction storm water management practices.

- Pollution Prevention Practices for the Municipality: MS4 storm water programs are to include practices to prevent pollutants from municipally-owned transportation infrastructure, maintenance areas, storage yards, sand and salt storage areas, and waste transfer stations entering the storm sewer system.
- Developed Urbanized Area Standard: Municipalities are required to control the Total Suspended Solids (TSS) carried in storm water from existing urban areas as compared to no controls. Many municipalities have already achieved the state standard of 20% TSS. Compliance with the standard is achieved by implementing a system of practices and activities, which has been verified by a storm water computer model.
- Storm Sewer System Maps: Municipalities covered by a MS4 permit area are required to maintain a map of the storm sewer system. These maps identify storm sewer conveyances such as pipes and ditches, and also identify roads, streams and lakes.
- Impaired Waters: Many streams and lakes in Wisconsin are polluted or impaired to a point that animal and plant communities in the receiving waters are significantly impacted. If the storm sewer system discharges a pollutant of concern to an impaired water, a municipality covered by a MS4 permit is required to develop a plan to reduce those pollutants.

3.3 Future Directions

Wisconsin partners will continue to work with regulated entities to manage nutrients through traditional permits and innovative approaches such as pollutant trading and the Watershed Adaptive Management Option discussed in Chapter 5 of this strategy.

Chapter 4. Agricultural Nonpoint Nutrients

Element 4. Agricultural Areas

4.1 EPA and Gulf Hypoxia Task Force Expectations

Quoted from EPA's recommended elements:
"In partnership with Federal and State Agricultural partners, NGOs, private sector partners, landowners, and other stakeholders, develop watershed-scale plans that target the most effective practices where they are needed most. Look for opportunities to include innovative approaches, such as targeted stewardship incentives, certainty agreements, and N & P markets, to accelerate adoption of agricultural conservation practices. Also, incorporate lessons learned from other successful agricultural initiatives in other parts of the country."

4.2 Wisconsin's Approach

For more than 30 years, an array of governmental and nongovernmental partners in Wisconsin have cooperated to implement a suite of federal, state, and local agricultural nonpoint source programs to control nutrients, sediments, and other pollutants. Collectively, these programs operate statewide using a blend of education, technical assistance, financial assistance, and compliance. Coordination occurs through a number of committees, forums, and both formal and informal working arrangements. Wisconsin's long history in this area includes many innovations, including the former Priority Watershed Program, rules specifying agricultural performance standards and prohibitions, and new approaches currently underway (described in Chapter 5 of this strategy) for reducing phosphorus through pollutant trading and the watershed adaptive management option. An expanded discussion of Wisconsin's approach including partners, statutory and administrative authority, planning framework, and implementation programs can be found in Wisconsin's Nonpoint Source Program Management Plan (http://dnr.wi.gov/topic/nonpoint/aboutnpsprogram.html). This chapter outlines some of Wisconsin's approach for agricultural areas by describing the agricultural performance standards and prohibitions and highlighting several agency programs and coordination forums.

4.2.1 Agricultural Performance Standards and Prohibitions

Wisconsin's agricultural performance standards and prohibitions identify requirements to control runoff from agricultural fields, pastures, and livestock facilities. All farmers in Wisconsin must comply with the requirements if cost-sharing is made available. As noted in Chapter 3, CAFOs must also follow additional requirements outlined in WPDES permits. Farmers must demonstrate compliance to participate in some state and local programs (such as the Wisconsin's Farmland Preservation Tax Credit) or to obtain local and state permits (e.g., for livestock siting and manure storage facilities). A variety of educational, technical assistance, and financial assistance programs are available to help farmers comply with the standards and prohibitions. Several are described in more detail later in this chapter. A partial list includes:

- Targeted Runoff Management Grants – DNR

- Urban Runoff Management Grants – DNR
- Notice of Discharge Grants – DNR
- Managed Forest Program – DNR
- Clean Water Fund loans and grants – DNR
- Soil and Water Management Grants – DATCP
- Clean Sweep
- Farmer Nutrient Management Plan training – UWEX
- Environmental Quality Incentives Program (EQIP) – NRCS
- Conservation Stewardship Program (CSP) – NRCS
- County grants and technical assistance

Table 4.1 Selected Federal and State Funding Programs

Program	Agency	2013 Funding ($ million)
Environmental Quality Incentives Program	NRCS – USDA	29.0
Conservation Stewardship Program (2012)	NRCS -- USDA	3.1
Funding to Counties -- staffing	DATCP	8.6
Funding to Counties – cost sharing	DATCP	5.8
Targeted Runoff Management	DNR	4.8
Total for listed programs		51.83

Additional resources, including federal programs, are identified in the Wisconsin's Nonpoint Source Program Management Plan (http://dnr.wi.gov/topic/nonpoint/aboutnpsprogram.html).

A brief description of the agricultural performance standards and manure management prohibitions from ch. NR 151, Wis. Adm. Code, is included here. The tillage setback and PI performance measure noted below became effective in 2011. The full rule can be found at: http://legis.wisconsin.gov/rsb/code/nr/nr151.pdf.

Wisconsin's Agricultural Performance Standards and Prohibitions:

- Tillage setback: A setback of 5 feet from the top of a channel of a waterbody for the purpose of maintaining stream bank integrity and avoiding soil deposits into state waters. Tillage setbacks greater than 5 feet but no more than 20 feet may be required if necessary to meet the standard. Harvesting of self-sustaining vegetation within the tillage setback is allowed.
- Phosphorus Index (PI): A limit on the amount of phosphorus that may run off croplands as measured by a phosphorus index with a maximum of 6, averaged over an eight-year accounting period, and a PI cap of 12 for any individual year.
- Process wastewater handling: a prohibition against significant discharge of process wastewater from milk houses, feedlots, and other similar sources.
- Meeting TMDLs: A standard that requires crop and livestock producers to reduce discharges if necessary to meet a load allocation specified in an approved Total Maximum Daily Load (TMDL). Producers must implement targeted performance standards specified for the TMDL area using best management practices specified in ch. ATCP 50, Wis. Adm. Code. If a more stringent or additional performance standard is necessary, it must be promulgated by rule before compliance is required.

- Sheet, rill and wind erosion: All cropped fields shall meet the tolerable (T) soil erosion rate established for that soil. This provision also applies to pasture lands.
- Manure storage facilities: All new, substantially altered, or abandoned manure storage facilities shall be constructed, maintained or abandoned in accordance with accepted standards, which includes a new margin of safety. Failing and leaking existing facilities which pose an imminent threat to public health or fish and aquatic life or violate groundwater standards shall be upgraded or replaced.
- Clean water diversions: Runoff from agricultural buildings and fields shall be diverted away from contacting feedlots, manure storage areas and barnyards located within water quality management areas (300 feet from a stream or 1,000 feet from a lake or areas susceptible to groundwater contamination).
- Nutrient management: Agricultural operations applying nutrients to agricultural fields shall do so according to a nutrient management plan. This standard does not apply to applications of industrial waste, municipal sludge or septage regulated under other DNR programs provided the material is not commingled with manure prior to application.
- Manure management prohibitions include: no overflow of manure storage facilities, no unconfined manure piles in a water quality management area, no direct runoff from feedlots or stored manure into state waters, no unlimited livestock access to waters of the state in locations where high concentrations of animals prevent the maintenance of adequate or self-sustaining sod cover.

4.2.2 Best Management Practices for Nonpoint Source Pollution Control

Wisconsin has identified best management practices (BMPs) that may be used to address agricultural, urban, and other categories or sources of NPS pollution and to meet the statewide performance standards and prohibitions. BMPs are enumerated in chs. NR 154 and ATCP 50, Wis. Adm. Code. See Table 4.2. Other practices may be approved when determined necessary to meet water quality objectives.

Table 4.2 Best Management Practices Outlined in ch. NR 154 and ch. ATCP 50, Wis. Adm. Code.

Legal Authority		BMP	Primary Pollutant(s) Addressed
NR 154.04	ATCP 50.62	Manure storage systems	Nutrients
NR 154.04	ATCP 50.63	Manure storage systems closure	Nutrients
NR 154.04	ATCP 50.64	Barnyard runoff control systems	Nutrients
NR 154.04	ATCP 50.65	Access roads and cattle crossings	Sediment, Nutrients
NR 154.04	ATCP 50.66	Animal trails and walkways	Sediment, Nutrients
NR 154.04	ATCP 50.67	Contour farming	Sediment, Nutrients
NR 154.04	ATCP 50.68	Cover and green manure crop	Sediment, Nutrients
NR 154.04	ATCP 50.69	Critical area stabilization	Sediment, Nutrients
NR 154.04	ATCP 50.70	Diversions	Sediment, Nutrients
NR 154.04	ATCP 50.71	Field windbreaks	Sediment, Nutrients
NR 154.04	ATCP 50.72	Filter strips	Sediment, Nutrients
NR 154.04	ATCP 50.73	Grade stabilization	Sediment, Nutrients
NR 154.04	ATCP 50.74	Heavy use area protection	Sediment, Nutrients
NR 154.04	N/A	Lake sediment treatment	Sediment, Nutrients
NR 154.04	ATCP 50.75	Livestock fencing	Sediment, Nutrients
NR 154.04	ATCP 50.76	Livestock watering systems	Sediment, Nutrients
NR 154.04	ATCP 50.77	Milking center waste control systems	Nutrients
NR 154.04	ATCP 50.78	Nutrient management	Sediment, Nutrients
NR 154.04	ATCP 50.79	Pesticide management	Pesticides

Legal Authority		BMP	Primary Pollutant(s) Addressed
NR 154.04	ATCP 50.80	Prescribed grazing	Sediment, Nutrients
NR 154.04	ATCP 50.81	Relocating or abandoning animal feeding operations	Sediment, Nutrients
NR 154.04	ATCP 50.82	Reside management	Sediment, Nutrients
NR 154.04	ATCP 50.83	Riparian buffers	Sediment, Nutrients
NR 154.04	ATCP 50.84	Roofs for animal lot and manure storage structures	Nutrients
NR 154.04	ATCP 50.85	Roof runoff systems	Nutrients
NR 154.04	ATCP 50.86	Sediment basins	Sediment, Nutrients
NR 154.04	N/A	Shoreline habitat restoration for developed areas	Sediment, Nutrients
NR 154.04	ATCP 50.87	Sinkhole treatment	Nutrients
NR 154.04	ATCP 50.88	Streambank and shoreline protection	Sediment, Nutrients
NR 154.04	ATCP 50.89	Strip-cropping	Sediment, Nutrients
NR 154.04	ATCP 50.90	Subsurface drains	Sediment, Nutrients
NR 154.04	ATCP 50.91	Terrace systems	Sediment, Nutrients
NR 154.04	ATCP 50.92	Underground outlets	Sediment, Nutrients
NR 154.04	ATCP 50.93	Waste transfer systems	Nutrients
NR 154.04	ATCP 50.94	Wastewater treatment strips	Nutrients
NR 154.04	ATCP 50.95	Water and sediment control basins	Sediment, Nutrients
NR 154.04	ATCP 50.96	Waterway systems	Sediment, Nutrients
NR 154.04	ATCP 50.97	Well decommissioning	Nutrients
NR 154.04	ATCP 50.98	Wetland development	Sediment, Nutrients
NR 154.04	N/A	Urban best management practices	Sediment, Nutrients

Refer here for complete details about chapters NR154 and ATCP50:
(http://legis.wisconsin.gov/rsb/code/nr/nr154.pdf
http://legis.wisconsin.gov/rsb/code/atcp/atcp050.pdf)

4.2.3 Programs intended to control agricultural nitrogen and phosphorus

As noted, Wisconsin's approach to reducing agricultural nonpoint source pollution includes many programs conducted by federal, state, and local governments, generally in cooperation with nongovernmental organizations. Many of the programs include connections to Wisconsin's agricultural performance standards and prohibitions. Several key programs are described below. Additional programs and details are described in Chapter 4 of Wisconsin's Nonpoint Source Program Management Plan (http://dnr.wi.gov/topic/nonpoint/aboutnpsprogram.html).

EPA Section 319 Grants (and TMDL implementation)

Federal funds provided to Wisconsin through EPA's Section 319 program address agricultural watersheds through direct projects and through multiple programs. These include:

- DNR Targeted Runoff Management (TRM) grants. This program supports implementation of nutrient reduction practices in large and small watersheds of both TMDL and non-TMDL classification.
- DNR Lake Management grants. Qualified units of government are eligible for funding to collect and analyze information needed to protect and restore lakes and their watersheds, including nutrient reduction actions.
- Funds also support DNR and DATCP technical and administrative capacity to implement nonpoint source programs.

USDA-NRCS Environmental Quality Incentives Program (EQIP)

EQIP has been the core of NRCS's agricultural conservation practice incentives program since 1997. EQIP is predominantly a source of non-targeted funding that pays cost-sharing for numerous structural and non-structural nutrient and sediment reduction practices on cropland, farmsteads and stream-side sites.

Common practices funded for Wisconsin producers include grassed waterways, cover crops, nutrient management planning, contour farming and strip-cropping, stream bank management practices and manure storage structures. There are several dozen total practices. The EQIP program is a combination of technical and financial assistance in one program and is implemented by NRCS with support from county land conservation departments. For more information, see: http://www.wi.nrcs.usda.gov/programs/eqip.html).

NRCS Conservation Stewardship Program (CSP)

CSP was created by the 2002 Farm Bill as an alternative strategy to incentivize installation of conservation practices. For EQIP a resource concern (problem) must exist to be eligible for financial assistance. Under CSP a producer fills out a Conservation Management Tool to describe the nature of their farming operation. The tool rates the relative level of conservation protection existing on the farm and establishes an annual base level payment. Farmers accepted into the program are required to maintain their existing level of conservation protection over the 5-year contract period and must implement additional conservation activities as agreed. The annual payment is based on the initial level of conservation performance and the level of protection offered by the additional conservation activities. For more information see: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1046181.pdf)

NRCS – Great Lakes Restoration Initiative (GLRI) projects

Wisconsin NRCS participates in the GLRI, a multi-federal-agency effort to restore priority watersheds in the Great Lakes basin (Figure 4.1). Technical assistance is currently available to producers located in the Lower Fox, Manitowoc-Sheboygan, and Milwaukee watersheds to assist with conservation planning needs. Financial assistance through EQIP/GLRI is anticipated to be available in 2013 for implementation of select conservation practices. (for more information: http://www.wi.nrcs.usda.gov/programs/eqip/GLRI/glri.html)

NRCS – Mississippi River Basin Healthy Watersheds Initiative (MRBI) projects

To improve the health of the Mississippi River Basin, NRCS has established the Mississippi River Basin Healthy Watersheds Initiative (MRBI). Through this Initiative, NRCS and its partners help producers in selected watersheds in the Mississippi River Basin voluntarily implement conservation practices that avoid, control, and trap nutrient runoff; improve wildlife habitat; and maintain agricultural productivity.

Wisconsin NRCS currently has a MRBI-EQIP project in place in the Six-mile Creek watershed in Dane County (see http://www.wi.nrcs.usda.gov/programs/mrbi.html). This targeted technical and financial assistance program supports the Watershed Adaptive Management option process being led by numerous partners, including producers, Dane County Department of Land and Water Resources and Madison Metropolitan Sewerage District and its customers.

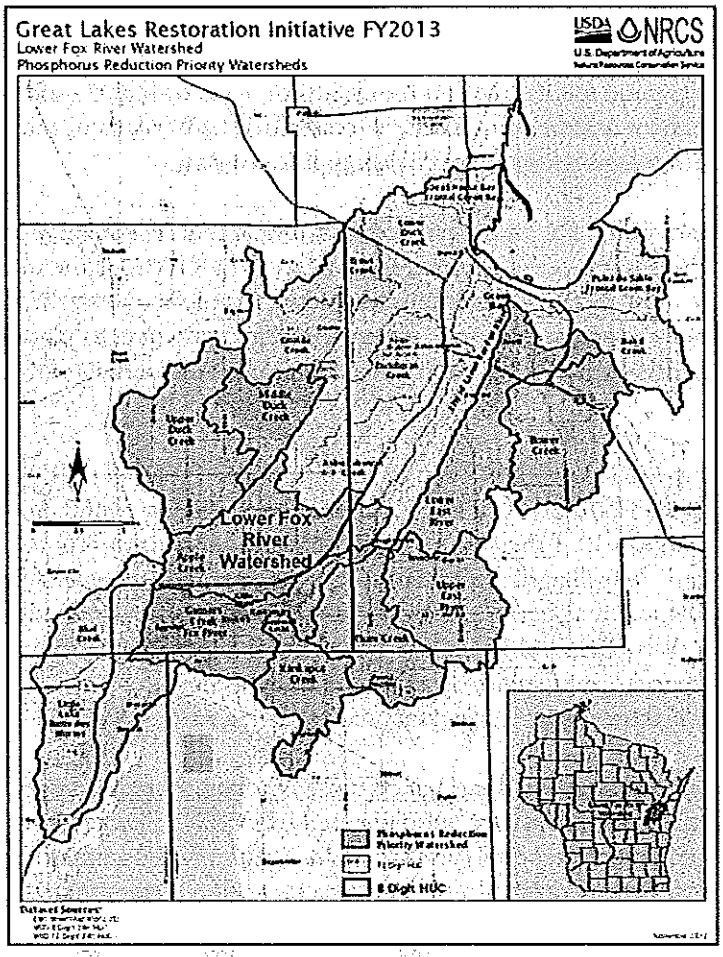

Figure 4.1 Map of NRCS-GLRI Project for the Lower Fox River Watershed

NRCS National Water Quality Initiative

This relatively new initiative by NRCS provided funding for nutrient and sediment reduction practices in watersheds selected with input from several state and local partners. These HUC 12 watersheds were selected in part because they contained water bodies included on Wisconsin's Impaired Waters list. NRCS field offices work in partnership with county land conservation departments to provide technical assistance to landowners. Funding is provided through EQIP.

Funding for FY 2012 was allocated in these locations (HUC 12 Watersheds):

- Lower Waumandee Creek – Buffalo County
- Ward Creek-Little Sugar River - Dane and Green Counties (additional funding provided by DNR through Gulf Hypoxia Project funding)
- Big Green Lake - Green Lake County

FY 2013 funding will continue in the Big Green Lake project and two additional watersheds.
http://www.wi.nrcs.usda.gov/programs/eqip/nwqi.html

USDA Farm Service Agency – Conservation Reserve Program (CRP)
Like many states, the CRP program in Wisconsin has played a significant role in trying to improve water quality by getting permanent cover on thousands of acres of highly erodible land. These grasslands reduce sediment and nutrient delivery to streams. In Wisconsin, this is especially true in the un-glaciated Driftless region within the Mississippi River Basin.

The program, administered by FSA, pays landowners annual rent in exchange for taking cropland out of production. NRCS, supported by county land conservation departments, provides technical assistance. Increasing market prices for commodities such as corn and soybeans—and the pressure that places on land rents—has created strong incentive for landowners to place these lands back into production once contracts expire. This trend may impact nutrient loading and related water quality conditions.

FSA also administers the Conservation Reserve Enhancement Program (CREP), through a federal-state-local partnership with NRCS, DATCP, DNR and participating county land conservation departments throughout much of the state. CREP provides an opportunity for Wisconsin landowners to voluntarily enroll agricultural lands into conservation practices, such as riparian buffers, filter strips, wetland restorations, waterways and establishment of native grasslands in the grassland project area. Wisconsin landowners have enrolled 44,000 acres of these practices in CREP with benefits for reduction of phosphorus, nitrogen, and sediment.
(http://datcp.wi.gov/Environment/Land_and_Water_Conservation/CREP/)

DATCP Farmland Preservation/Working Lands cross compliance requirements
The Wisconsin Working Lands Initiative, administered by DATCP, includes the Farmland Preservation Program, Agricultural Enterprise Area Program, and Purchase of Agricultural Conservation Easement Program. The Initiative seeks to preserve areas that are significant for current and future agricultural uses and requires cross-compliance with the ch. NR 151, Wis. Adm. Code, agricultural performance standards and prohibitions discussed above. For more information, visit (http://datcp.wi.gov/Environment/Working_Lands_Initiative/).

County Land and Water Resource Management Plan Implementation
The Land and Water Resource Management (LWRM) Planning Program, administered by DATCP, is an important vehicle for targeting and implementing conservation practices. The program requires that counties develop LWRM plans to conserve soil, water and other natural resources. The plans advance land and water conservation and attempt to reduce NPS pollution by:

- Inventorying water quality and soil erosion conditions in the county.
- Setting water quality goals, in consultation with the DNR.
- Identifying priority farm areas using a range of criteria (e.g., impaired waters, manure management, high nutrient applications).
- Identifying key water quality and soil erosion problems, and practices to address those problems.
- Identifying strategies to promote voluntary compliance with statewide performance standards and prohibitions, including information, cost-sharing, and technical assistance.
- Identifying enforcement procedures, including notice and appeal procedures.
- Including a multi-year work plan to achieve soil and water conservation objectives.
- Identifying relevant state and local regulations, and any inconsistencies between them.

County Land Conservation Department (LCD) staff are key stakeholders in the development and implementation of comprehensive watershed management plans that address water quality impairments. The knowledge, skills, and connections to local landowners and producers that local LCDs provide are a key component in the development of any comprehensive watershed plan, as well as implementation of practices and programs designed to improve water quality.

DNR Targeted Runoff Management (TRM) Grant and Notice of Discharge (NOD) grant-funded projects

TRM grants may be used to cost share the installation of best management practices and support a variety of local administrative and planning functions. Projects are selected through a competitive scoring system and generally take two to three years to complete. The TRM grant program has evolved into a three-tiered structure to provide flexibility in addressing a range of scales, from single sites to small sub-watersheds. (For more information, see Chapter 4.7a of Wisconsin's Nonpoint Source Program Management Plan at http://dnr.wi.gov/topic/nonpoint/documents/npsprogrammgmtplan6282011.pdf).

DNR Safe Drinking Water Protection Pilot Projects

DNR Bureau of Drinking Water and Groundwater is conducting pilot projects to target sub-watersheds with high levels of nitrate identified in public drinking water systems (greater than 5 mg/L) and potential agricultural contributions. The pilot projects seek to assess and control potential agricultural contributions through a mix of incentives.

Information and Education

Information and education programs and activities are conducted through the network of agencies and organizations involved in nutrient reduction. Efforts include statewide programs organized by state and federal agencies and nongovernmental partners (see coordination forums below), as well as local field days, farm visits, skills training, informational workshops, and development and delivery of educational materials. For more information, see section 4.6 of Wisconsin's Nonpoint Source Program Management Plan.

Wisconsin's Farmer-led Initiative

Wisconsin is exploring new approaches to engage farmers in solving water quality restoration and protection challenges related to agricultural nonpoint sources. Based on successful models in Iowa and Minnesota, conservation partners in Wisconsin are providing coordination and technical support for farmer-led watershed councils in tributary watersheds to the St Croix River basin and the Red Cedar River basin. Each farmer-led watershed councils establishes performance measures to address production and water quality issues.

UW Discovery Farms and UW Pioneer Farm

UW Discovery Farms focus on economic and environmental effects of agricultural practices through on-farm research and outreach and training programs. In cooperation with working farms, UW Discovery Farms considers a comprehensive, whole-farm approach to understanding interactions between agricultural practices, farm profitability, farm management, and water quality. (http://uwdiscoveryfarms.org). UW Pioneer Farm, part of UW-Platteville's School of Agriculture, conducts systems and applied research on management practices in a working farm setting and provides training and outreach for students, agencies, producers, and the public. (http://www.uwplatt.edu/pioneerfarm/)

University of Wisconsin System

Beyond the UW Discovery Farms and UW Pioneer Farm programs described above, many research partnerships coordinated through the University of Wisconsin System also address agricultural nutrients and water quality. In many cases, research is coordinated with agencies, local governments, agricultural associations, and other stakeholders, and encompasses research on private working farms and university research facilities. Several examples include ongoing projects led by various faculty members at UW institutions including UW-Madison through the College of Agricultural and Life Sciences (CALS), College of Engineering, and the network of UW Agricultural Research Stations. Numerous UW Extension centers and teams also address issues of agricultural nutrients. UW also has two members serving on the Wisconsin Groundwater Coordinating Council. Additional information can be found through web searches on key terms.

SIDEBARS:

Runoff Risk Advisory Forecast

Wisconsin DATCP and numerous partners developed this useful online tool designed to help farmers evaluate the future risk of manure runoff due to snowmelt or rainfall. The tool consists of a map indicating day-to-day risk of manure runoff, based on National Weather Service (NWS) flood forecast model that incorporates precipitation potential, soil moisture and the physical characteristics of 242 NWS basins. The tool (http://144.92.93.196/app/runoffrisk) is accessible in a variety of mobile electronic formats.

SnapPlus Nutrient Management Software

SnapPlus (Soil Nutrient Application Planner) is software to prepare nutrient management plans according to the NRCS Nutrient Management Standard 590. Developed by the University of Wisconsin, SnapPlus generates the following outputs:

- Crop nutrient requirements (N-P-K) according to soil test results and nutrient credits
- Soil loss assessment based on the Revised Universal Soil Loss Equation (RUSLE-2)
- A phosphorus index for all fields across a crop rotation
- A rotational phosphorus balance for using soil test P as the criteria for phosphorus management

SnapPlus is used heavily by private crop consultants, farmers and other nutrient management planners and is regularly updated to incorporate new tools and information. For more information visit snapplus.wisc.edu.

4.2.4 Forums for coordination and engagement

A number of forums exist for coordination and engagement among agencies, NGOs, and agricultural interests that address nutrient management and reduction. These include:

- NRCS State Technical Committee – provides advice to NRCS on a variety of program and policy issues relevant for Wisconsin conservation. (http://www.wi.nrcs.usda.gov/about/stc.html)
- Wisconsin Land and Water Conservation Board – reviews and makes recommendations on county land and water conservation plans, makes recommendations for funding allocations, and provides a forum for land and water conservation issues. (http://datcp.wi.gov/Environment/Land_and_Water_Conservation/Land_and_Water_Conservation_Board/index.aspx)
- Biosolids Symposium -annually addressing applications on agricultural lands
- Governmental Affairs Seminar for point sources
- Standards Oversight Council (SOC) – a multi-agency council that oversees the development and maintenance of conservation technical standards for Wisconsin (http://socwisconsin.org)
- Wisconsin Crop Management Conference (WCMC) – a 3-day annual event drawing 1,500 attendees focused on the agronomic inputs industry. (http://www.soils.wisc.edu/extension/wcmc/)
- UW-Extension Soil, Water, and Nutrient Management Meetings (SWNM) – annual meetings held across the state drawing 600 attendees annually
- Many watershed-level forums and initiatives – for example, annual conference and coordination events focused on specific river basins and watersheds.
- Many ad hoc statewide workgroups such as a recent effort to improve the effectiveness of agricultural nutrient management convened by WLWCA, DATCP, and others.

4.3 Future Directions

Wisconsin is moving forward on many initiatives related to understanding and managing nutrients from agricultural areas and their impacts on surface water and groundwater. Those issues continue to be a focus for the broad set of partners discussed in this chapter. Among them are questions of reducing nitrogen losses or increasing nitrogen use efficiency, particularly in coarse soil; understanding and increasing actual implementation of nutrient management plans; understanding the dynamics of surface to subsurface flows of nitrogen and phosphorus in tile drainage; expanding development and use of 9-element watershed plans; and gaining experience with the innovative integrated approaches described in the next chapter. Two current additional activities relevant to nutrient reduction are the NRCS 590 Nutrient Management Standard revisions and a proposed Nitrogen Science Summit, both discussed below.

NRCS 590 Nutrient Management Standard Revision

Many questions are being addressed through an ongoing process to revise the NRCS 590 Nutrient Management Standard. This process, led by NRCS and coordinated through the Wisconsin Standards Oversight Council (SOC), involves a review team to provide interdisciplinary input to revise the standard. The effort includes input from farmers, researchers, water quality and agricultural agency staff and agricultural service providers. The 590 review process will address

nitrogen use efficiency and losses, along with several other significant technical issues with regard to nutrient management planning, including[15]:

- Creation of a Nitrogen Loss Risk Assessment Tool
- Developing a winter nutrient spreading risk assessment tool
- Soil test phosphorus criteria
- Soil test recommendation revisions from UW-Extension
- Add analysis for manure ammonium nitrogen content (consistent with the NRCS national 590 practice standard)
- Evaluate the potential for transport of nutrients to tile drainage
- Adaptive nutrient management - develop a process to establish a representative yield check strip when nutrients are applied above the rates established by the standard unanticipated crop production conditions
- Developing a manure land base estimate (for animal feeding operations) - to address requirements for addressing the remaining volume of manure or other nutrient source if an adequate land base is NOT available

Exploring these technical issues through the revision to NRCS 590 will address a number of nutrient management issues, particularly relating to nitrogen losses to both surface water and groundwater. The NRCS 590 revision work is expected to continue through 2014.

Nitrogen Science Summit

Wisconsin is considering initiating a separate long-term process for examining nitrogen management beginning with a Nitrogen Science Summit to identify what is known and what is unknown focusing both on surface water and groundwater needs.

While a major commitment has been made by agencies and universities in Wisconsin over more than two decades to develop tools and indices to manage phosphorus on agricultural lands, comparable tools and indices are likely needed to better manage nitrogen. The purpose of a Nitrogen Science Summit would be to create new tools to determine which practices are recommended on a given site and how effective they may be – especially considering the very complex nature of nitrogen use and mobility on agricultural lands. A Nitrogen Science Summit would draw from recent development from other states, including Iowa and Minnesota.

The Nitrogen Science Summit could include literature reviews and discussion of the following items:

- Definition of Wisconsin's surface water quality needs and groundwater quality needs related to nitrogen.
- Pathways of nitrogen to both surface waters and groundwater and the relative contribution of nitrogen in runoff verses nitrogen in groundwater reaching streams and lakes.
- Movement of nitrogen through the many diverse soils present in Wisconsin.
- Determination of relative nitrogen contribution of cropped fields, pastures, animal lots and other lands.
- Geographic variation across Wisconsin and the potential use of agro-ecoregion designations as a tool.

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[15] Standards Oversight Council 590 Nutrient Management Team Charge, November 15, 2012 (NRCS, custodian)

- Compilation of existing data and information from research projects, including Pioneer Farm and Discovery Farms, and N management/loss research currently performed by the Agricultural Research Service (ARS) and the UW Soils Department.
- Assessment of the practicality and effectiveness of N loss reduction materials such as slow release urea/urease inhibitors.
- Role of field-based targets and surrogates to guide management.
- Economic costs and benefits – both on farm and off site – related to nitrogen management.
- Role of pilot projects to test and mold implementation and education processes, as well as to measure water quality changes resulting from project implementation.
- Identify research needed to fill knowledge gaps.
- Other items identified by a Summit scoping group.

The Nitrogen Science Summit would build upon Wisconsin's long-standing practice of using partnerships and coordination forums to exchange thoughts, ideas and information. Participants would include university, state, and federal researchers; water quality experts; federal, state and local agency program managers; consulting agronomists; practicing farmers; agricultural economists; educational experts; and others identified by a Nitrogen Science Summit scoping committee.